ZyXEL AG-220

802.11a/g Wireless USB Adapter

User's Guide

Version 1.10
Edition 1
5/2008

ZyXEL

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注意！

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This device has been designed for the WLAN 2.4 GHz and 5 GHz networks throughout the EC region and Switzerland, with restrictions in France.

This device has been designed for the WLAN 2.4 GHz network throughout the EC region and Switzerland, with restrictions in France.

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3. Select the certification you wish to view from this page.

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- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
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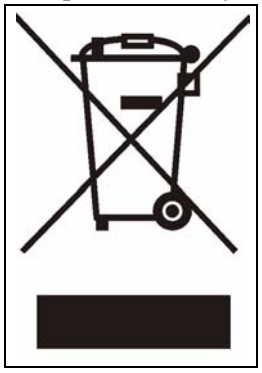
This product is recyclable. Dispose of it properly.



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+" is the (prefix) number you enter to make an international telephone call.

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Preface

Congratulations on your purchase of the ZyXEL AG-220 802.11a/g Wireless USB Adapter. Your AG-220 plugs into a USB port on your computer and allows you to access wireless networks.

Your AG-220 is easy to install and configure.

About This User's Guide

This manual is designed to guide you through the configuration of your AG-220 for its various applications.

Related Documentation

- Supporting Disk

  Refer to the included CD for support documents.

- Quick Start Guide

  The Quick Start Guide is designed to help you get up and running right away. They contain hardware installation/connection information.

- ZyXEL Web Site

  Please go to http://www.zyxel.com for product news, firmware, updated documents, and other support materials.

User Guide Feedback

Help us help you. E-mail all User's Guide-related comments, questions or suggestions for improvement to techwriters@zyxel.com.tw or send regular mail to The Technical Writing Team, ZyXEL Communications Corp., 6 Innovation Road II, Science-Based Industrial Park, Hsinchu, 300, Taiwan. Thank you.

Syntax Conventions

- "Enter" means for you to type one or more characters. "Select" or "Choose" means for you to use one predefined choice.
- Mouse action sequences are denoted using a right angle bracket (>). For example, "In Windows, click **Start** > **Settings** > **Control Panel**" means first click the **Start** button, then point your mouse pointer to **Settings** and then click **Control Panel**.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".
- The ZyXEL AG-220 802.11a/g Wireless USB Adapter may be referred to as the AG-220 in this user's guide.

Graphics Icons Key

Wireless Access Point	Computer	Notebook Computer
Server	Modem or Router	Wireless Signal
Internet Cloud		

CHAPTER 1
Getting Started

This chapter introduces the AG-220 and prepares you to use the ZyXEL utility.

1.1 About Your AG-220

The AG-220 is an IEEE 802.11a/b/g compliant wireless LAN adapter. You can also turn your AG-220 into an access point (AP) using the ZyXEL utility. The ZyXEL utility is a tool that helps you configure your AG-220. See the appendix for detailed product specifications.

1.1.1 Note for Windows Vista Users

The Windows Vista version of the ZyXEL utility has Wi-Fi Protected Setup (WPS). See Section 3.3 on page 41 and Section 4.7 on page 68 for more information.

At the time of writing the following functions are not available on Windows Vista:

- AP Mode (Section 2.3 on page 34).
- Encryption Settings - Login Name, Password and Logon Domain are not shown in the 802.1x and WPA/WPA2 screens. To configure these screens in Vista please see Section 4.8 on page 69.
- Ad-hoc channel and wireless mode settings (Section 4.4.1 on page 62).
- The Advanced Screen (Section 4.5 on page 66).

1.2 Application Overview

This section describes some network applications for the AG-220.

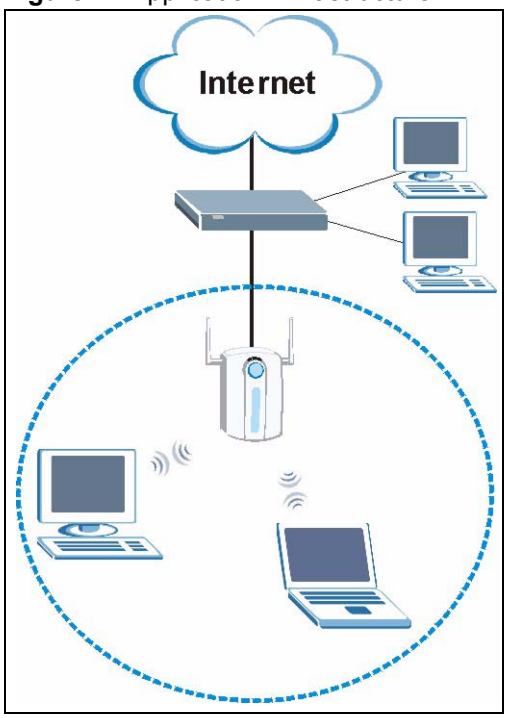
1.2.1 Station Mode

The AG-220 is in wireless station mode by default. When the AG-220 works as a wireless station (wireless client), you can either set the network type to **Infrastructure** and connect to an AP or use **Ad-Hoc** mode and connect to a peer computer (another wireless device in Ad-Hoc mode).

1.2.1.1 Infrastructure

To connect to a network via an access point (AP), set the AG-220 network type to **Infrastructure**. Through the AP, you can access the Internet or the wired network behind the AP.

Figure 1 Application: Infrastructure

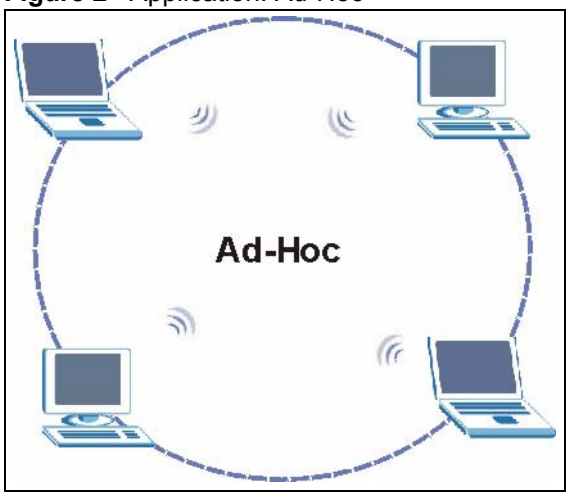


1.2.1.2 Ad-Hoc

To set up a small independent wireless workgroup without an AP, use **Ad-Hoc**.

Ad-Hoc does not require an AP or a wired network. Two or more wireless clients communicate directly with each other.

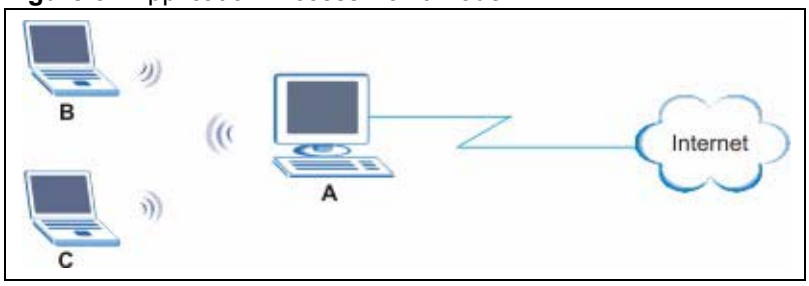
Figure 2 Application: Ad-Hoc



1.2.2 Access Point Mode

You can also set the AG-220 to access point mode. This allows you to set up your wireless networks without using a dedicated AP. The following figure shows a network example.

Figure 3 Application: Access Point Mode



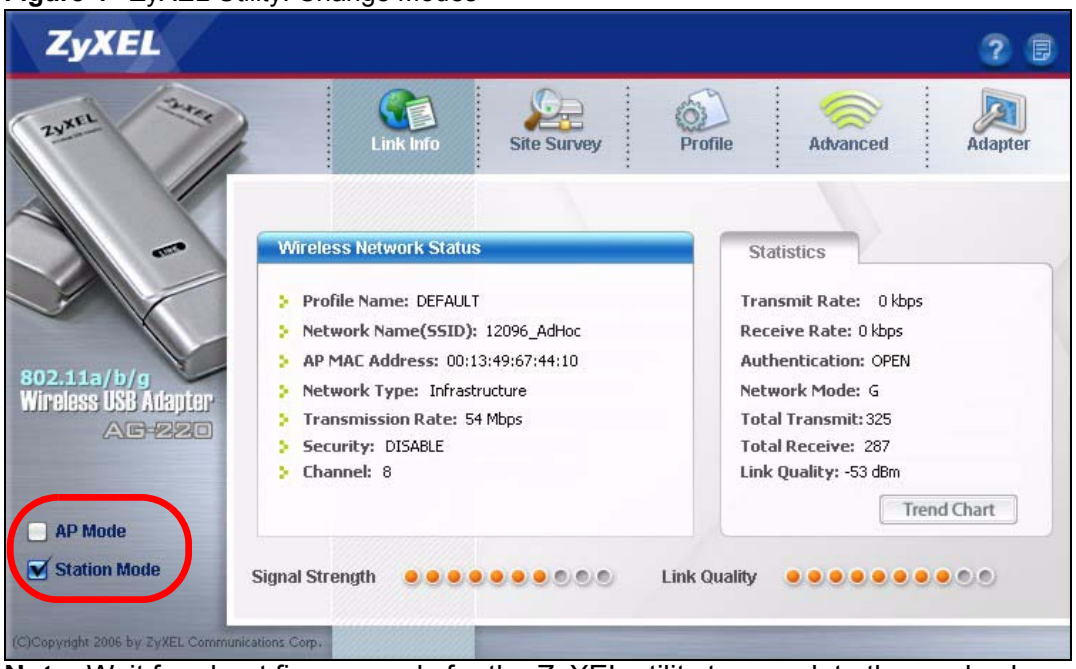
In the example, the AG-220 is installed on computer **A** and set to operate in access point mode. Computer **A** provides an Internet connection to the wireless LAN, so wireless stations **B** and **C** can access the Internet.

1.2.3 Changing AG-220 Mode

To change between the modes, select either **Station Mode** or **AP Mode** in any ZyXEL utility screens.

Note: This feature is not available in the Windows Vista utility. The Windows Vista utility only operates in **Station Mode**.

Figure 4 ZyXEL Utility: Change Modes



Note: Wait for about five seconds for the ZyXEL utility to complete the mode change.

The current mode is indicated by the color of the check box.

1.3 AG-220 Hardware and Utility Installation

Follow the instructions in the Quick Start Guide to install the ZyXEL utility and make hardware connections.

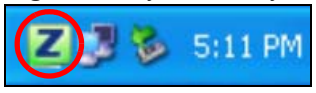
1.3.1 ZyXEL Utility Icon

After you install and start the ZyXEL utility, an icon for the ZyXEL utility appears in the system tray.

Note: The ZyXEL utility system tray icon displays only when the AG-220 is installed properly.

When you use the ZyXEL utility, it automatically disables Wireless Zero Configuration (WZC).

Figure 5 ZyXEL Utility: System Tray Icon



The color of the ZyXEL utility system tray icon indicates the status of the AG-220. Refer to the following table for details.

Table 1 ZyXEL Utility: System Tray Icon

COLOR	DESCRIPTION
Red	The AG-220 is operating in wireless station mode but is not connected to a wireless network.
Green	The AG-220 is operating in wireless station mode and is connected to a wireless network.
Pale Blue	The AG-220 is operating in access point mode.

1.4 Configuration Methods

To configure your AG-220, use one of the following applications:

- Wireless Zero Configuration (WZC) (the Windows XP wireless configuration tool)
- ZyXEL Utility (required when you want to use the AG-220 as an access point)

Note: Do NOT use WZC at the same time you use the ZyXEL utility.

1.4.1 Enabling WZC

Note: When you use the ZyXEL utility, it automatically disables WZC.

If you want to use WZC to configure the AG-220, you need to disable the ZyXEL utility by right-clicking the utility icon ( ) in the system tray and selecting **Exit**.

Figure 6 Enable WZC

Refer to the appendices for information on how to use WZC to manage the AG-220.

To reactivate the ZyXEL utility, double-click the ( ) icon on your desktop or click **Start**, **(All) Programs**, **ZyXEL AG-220 Wireless Adapter Utility**, **ZyXEL AG-220 Wireless Adapter Software**.

1.4.2 Accessing the ZyXEL Utility

Double-click on the ZyXEL wireless LAN utility icon in the system tray to open the ZyXEL utility.

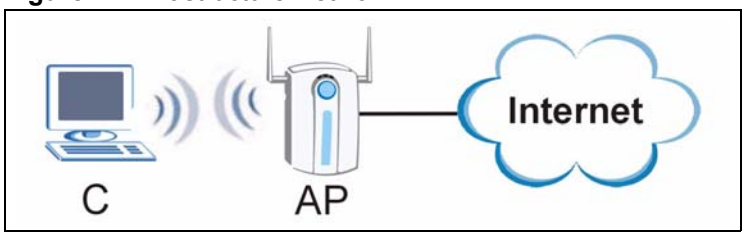
The ZyXEL utility screens are similar in all Microsoft Windows versions. Screens for Windows XP are shown in this User's Guide.

Note: Click the icon (located in the top right corner) to display the online help window.

CHAPTER 2
Tutorial

The following sections show you how to join a wireless network using the ZyXEL utility, as in the following diagrams. The wireless client is labeled **C** and the access point is labeled **AP**.

Figure 7 Infrastructure Network



There are three ways to connect the wireless client (the AG-220 in station mode) to a network.

- Configure nothing and leave the wireless client to automatically scan for and connect to any available network that has no wireless security configured.
- Manually connect to a network (see Section 2.1 on page 29).
- Configure a profile to have the wireless client automatically connect to a specific network or peer computer (see Section 2.2 on page 31).

This chapter also includes a simple example of how to configure the AG-220 as an AP using the ZyXEL utility. See Section 2.3 on page 34 for more information.

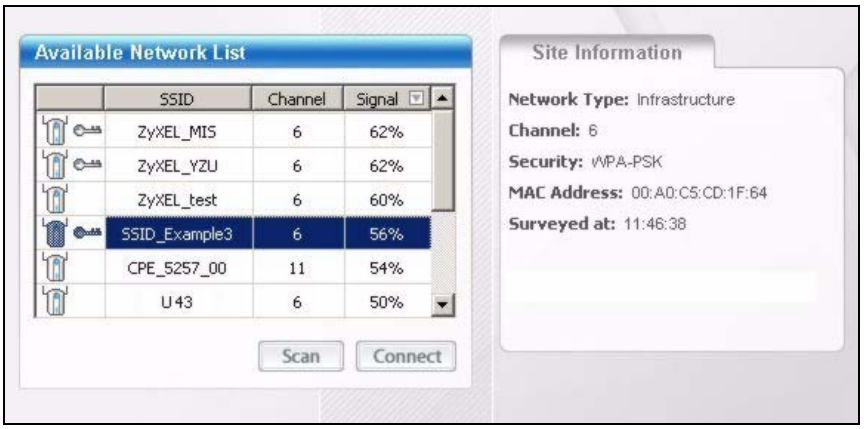
2.1 Connecting to a Wireless LAN

This example illustrates how to manually connect your wireless client to an access point (AP) configured for WPA-PSK security and connected to the Internet. Before you connect to the access point, you must know its Service Set IDentity (SSID) and WPA-PSK pre-shared key. In this example, the AP's SSID is "SSID_Example3" and its pre-shared key is "ThisismyWPA-PSKpre-sharedkey".

After you install the ZyXEL utility and then insert the wireless client, follow the steps below to connect to a network using the **Site Survey** screen.

1 Open the ZyXEL utility and click the **Site Survey** tab to open the screen shown next.

Figure 8 ZyXEL Utility: Site Survey



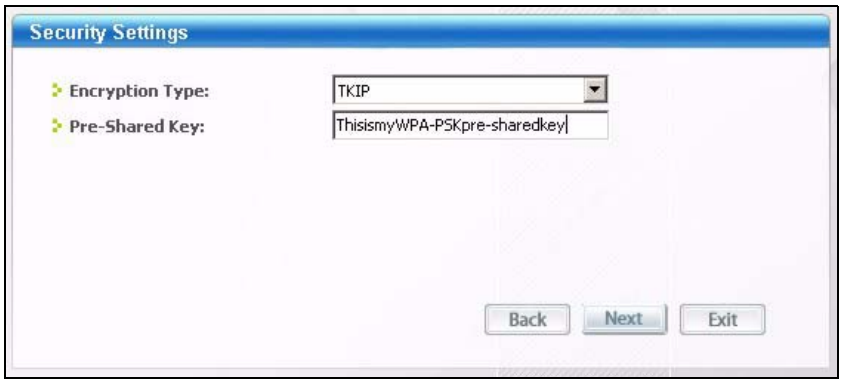
2 The wireless client automatically searches for available wireless networks. Click **Scan** if you want to search again. If no entry displays in the **Available Network List**, that means there is no wireless network available within range. Make sure the AP or peer computer is turned on, or move the wireless client closer to the AP or peer computer. See Table 5 on page 54 for detailed field descriptions.

3 To connect to an AP or peer computer, either click an entry in the list and then click **Connect** or double-click an entry (**SSID_Example3** in this example).

4 When you try to connect to an AP with security configured, a window will pop up prompting you to specify the security settings. Enter the pre-shared key and leave the encryption type at the default setting.

Use the **Next** button to move on to the next screen. You can use the **Back** button at any time to return to the previous screen, or the **Exit** button to return to the **Site Survey** screen.

Figure 9 ZyXEL Utility: Security Settings

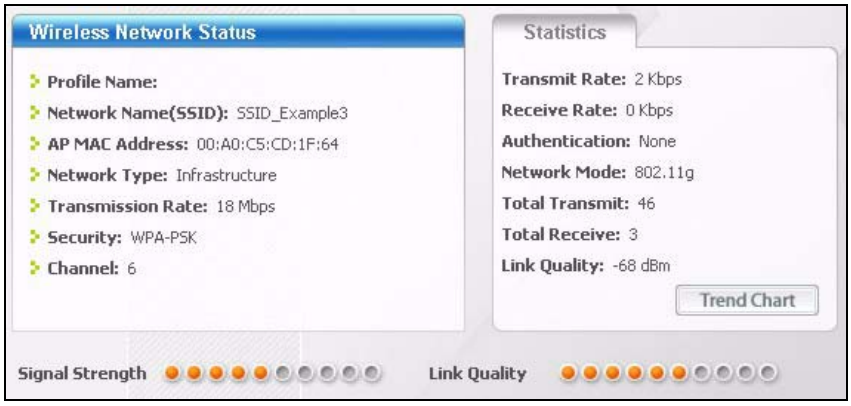


5 The **Confirm Save** window appears. Check your settings and click **Save** to continue.

Figure 10 ZyXEL Utility: Confirm Save

6 The ZyXEL utility returns to the **Link Info** screen while it connects to the wireless network using your settings. When the wireless link is established, the ZyXEL utility icon in the system tray turns green and the **Link Info** screen displays details of the active connection. Check the network information in the **Link Info** screen to verify that you have successfully connected to the selected network. If the wireless client is not connected to a network, the fields in this screen remain blank. See Table 3 on page 52 for detailed field descriptions.

Figure 11 ZyXEL Utility: Link Info



7 Open your Internet browser and enter http://www.zyxel.com or the URL of any other web site in the address bar. If you are able to access the web site, your wireless connection is successfully configured. If you cannot access the web site, check the Troubleshooting section of this User's Guide or contact your network administrator if necessary.

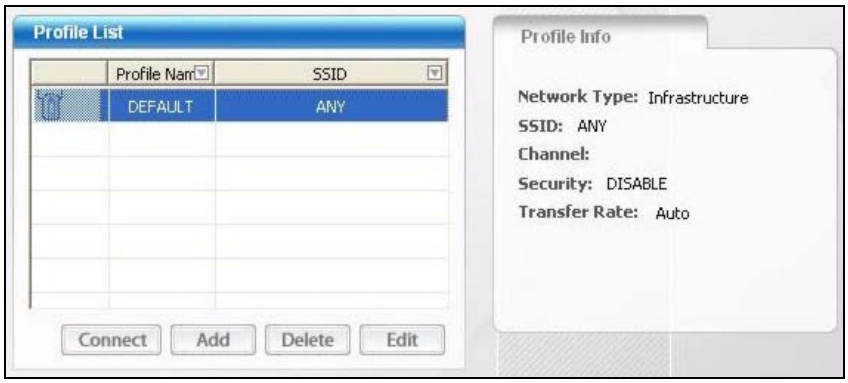
2.2 Creating and Using a Profile

A profile lets you automatically connect to the same wireless network every time you use the ZyXEL utility. You can also configure different profiles for different networks, for example if you connect a notebook computer to wireless networks at home and at work.

This example illustrates how to set up a profile and connect the wireless client to an access point configured for WPA-PSK security. In this example, the AP's SSID is "SSID_Example3" and its pre-shared key is "ThisismyWPA-PSKpre-sharedkey". You have chosen the profile name "PN_Example3".

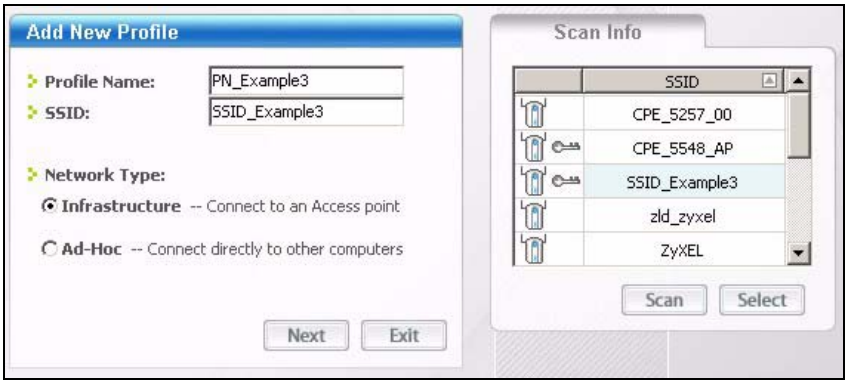
1 Open the ZyXEL utility and click the **Profile** tab to open the screen as shown. Click **Add** to configure a new profile.

Figure 12 ZyXEL Utility: Profile



2 The **Add New Profile** screen appears. The wireless client automatically searches for available wireless networks, which are displayed in the **Scan Info** box. You can also configure your profile for a wireless network that is not in the list.

Figure 13 ZyXEL Utility: Add New Profile



3 Give the profile a descriptive name (of up to 32 printable ASCII characters). Select **Infrastructure** and either manually enter or select the AP's SSID in the **Scan Info** table and click **Select**.

4 Choose the same encryption method as the AP to which you want to connect (In this example, WPA-PSK).

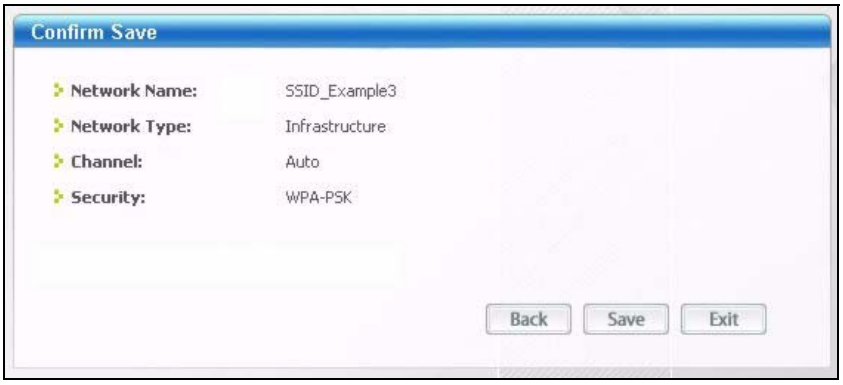
Figure 14 ZyXEL Utility: Profile Security

5 This screen varies depending on the encryption method you selected in the previous screen. In this example, enter the pre-shared key and leave the encryption type at the default setting.

Figure 15 ZyXEL Utility: Profile Encryption

6 Verify the profile settings in the ready-only screen. Click **Save** to save and go to the next screen.

Figure 16 ZyXEL Utility: Profile Confirm Save



7 Click **Activate Now** to use the new profile immediately. Otherwise, click the **Activate Later** button to go back to the **Profile List** screen.

If you clicked **Activate Later** you can select the profile from the list in the **Profile** screen and click **Connect** to activate it.

Note: Only one profile can be activated and used at any given time.

Figure 17 ZyXEL Utility: Profile Activate

8 When you activate the new profile, the ZyXEL utility goes to the **Link Info** screen while it connects to the AP using your settings. When the wireless link is established, the ZyXEL utility icon in the system tray turns green and the **Link Info** screen displays details of the active connection.

9 Make sure the selected AP in the active profile is on and connected to the Internet. Open your Internet browser, enter http://www.zyxel.com or the URL of any other web site in the address bar and press ENTER. If you are able to access the web site, your new profile is successfully configured.

10 If you cannot access the Internet, go back to the **Profile** screen. Select the profile you are using and click **Edit**. Check the details you entered previously. Also, refer to the Troubleshooting section of this User's Guide or contact your network administrator if necessary.

2.3 Configuring the AG-220 as an AP

Note: This mode is not available in the Windows Vista version of the utility.

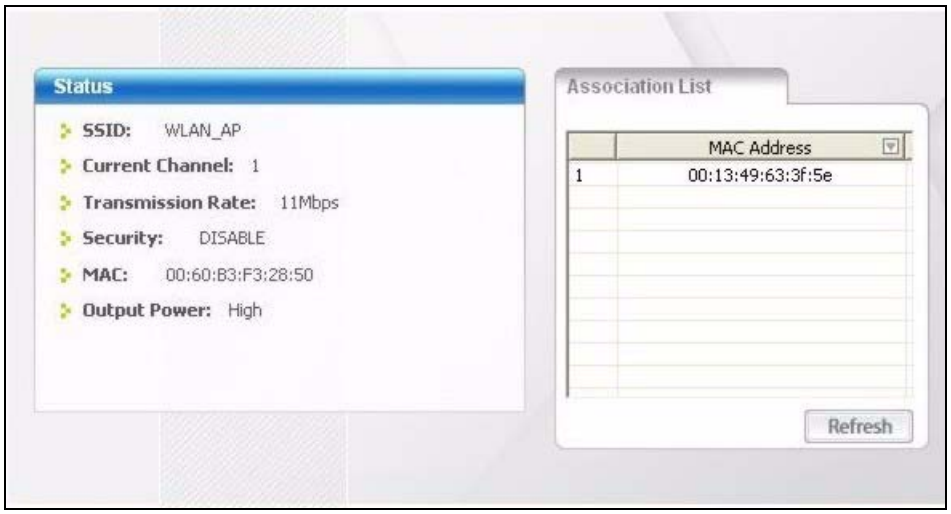
In access point mode, your AG-220 allows you to set up your wireless network without using a dedicated AP. Refer to Section 1.2.3 on page 25 and Chapter 5 on page 73 for more information.

Note: With WZC, you cannot use the AG-220 as an access point.

After you install the ZyXEL utility and then insert the AG-220, follow the steps below to set up your AG-220 as an AP.

1 Select **AP Mode** in any utility screen and wait for five seconds. The screen changes and displays as shown next. Under **Status**, you can view the current settings on the AG-220. In the **Association List**, you can see if any wireless clients have connected to your AG-220.

Figure 18 ZyXEL Utility: AP: Link Info



2 If you want to change the SSID and enable wireless security for your AG-220, click the **Configuration** tab and refer to Section 5.3 on page 75 for detailed field descriptions.

Note: Only WEP security is available when the AG-220 is in AP mode

Figure 19 ZyXEL Utility: AP: Configuration

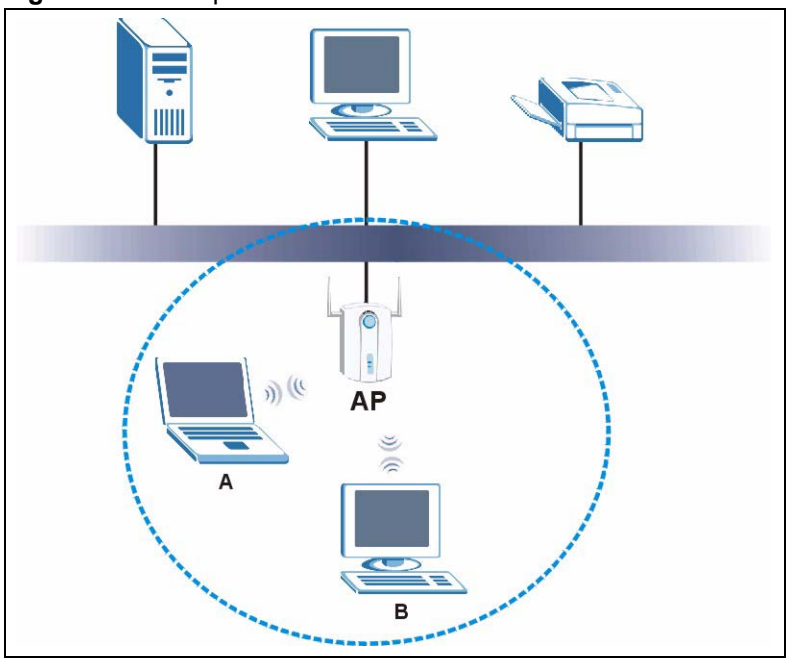
CHAPTER 3
Wireless LAN Network

This chapter provides background information on wireless LAN networks.

3.1 Wireless LAN Overview

The following figure provides an example of a wireless network with an AP. See Figure 2 on page 25 for an Ad Hoc network example.

Figure 20 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices **A** and **B** are called wireless clients. The wireless clients use the access point (AP) to interact with other devices (such as the printer) or with the Internet

Every wireless network must follow these basic guidelines.

- Every device in the same wireless network must use the same SSID.

  The SSID is the name of the wireless network. It stands for Service Set IDentity.
- If two wireless networks overlap, they should use a different channel.

  Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.

- Every device in the same wireless network must use security compatible with the AP or peer computer.

  Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

3.2 Wireless LAN Security

Wireless LAN security is vital to your network to protect wireless communications.

Configure the wireless LAN security using the **Configuration** or the **Profile Security Setting** screen. If you do not enable any wireless security on your AG-220, the AG-220's wireless communications are accessible to any wireless networking device that is in the coverage area.

Note: You can only use WEP encryption if you set the AG-220 to Ad-hoc or AP mode.

See the appendices for more detailed information about wireless security.

3.2.1 Hide SSID

Normally, the AG-220 in AP mode acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the AG-220 in AP mode does not broadcast the SSID. In addition, you should change the default SSID to something that is difficult to guess.

This type of security is fairly weak, however, because there are ways for unauthorized wireless devices to get the SSID. In addition, unauthorized wireless devices can still see the information that is sent in the wireless network.

3.2.2 MAC Address Filter

Every device that can use a wireless network has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02.

To get the MAC address for each device in the wireless network, see the device's User's Guide or other documentation. You can find the MAC address of the AG-220 by looking at the sticker on the bottom of the device. Alternatively, use the utility in AP mode and look at the **Link Info** screen. See Section 5.2 on page 74 for more details. You can also use the **Association List** in the **Link Info** screen (in AP mode) to get the MAC addresses of other wireless devices connected to the AG-220.

1. Some wireless devices, such as scanners, can detect wireless networks but cannot use wireless networks. These kinds of wireless devices might not have MAC addresses.
2. Hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

You can use the MAC address filter to tell the AG-220 in AP mode which devices are allowed or not allowed to use the wireless network. If a device is allowed to use the wireless network, it still has to have the correct information (SSID, channel, and security). If a device is not allowed to use the wireless network, it does not matter if it has the correct information.

This type of security does not protect the information that is sent in the wireless network. Furthermore, there are ways for unauthorized wireless devices to get the MAC address of an authorized device. Then, they can use that MAC address to access the wireless network.

3.2.3 User Authentication and Encryption

You can make every user log in to the wireless network before they can use it. This is called user authentication. However, every wireless client in the wireless network has to support IEEE 802.1x to do this.

Wireless networks can use encryption to protect the information that is sent in the wireless network. Encryption is like a secret code. If you do not know the secret code, you cannot understand the message.

3.2.3.1 WEP

3.2.3.1.1 Data Encryption

WEP (Wired Equivalent Privacy) encryption scrambles all data packets transmitted between the AG-220 and the AP or other wireless stations to keep network communications private. Both the wireless stations and the access points must use the same WEP key for data encryption and decryption.

There are two ways to create WEP keys in your AG-220.

- Automatic WEP key generation based on a "password phrase" called a passphrase. The passphrase is case sensitive. You must use the same passphrase for all WLAN adapters with this feature in the same WLAN.

  For WLAN adapters without the passphrase feature, you can still take advantage of this feature by writing down the four automatically generated WEP keys from the **Security Settings** screen of the ZyXEL utility and entering them manually as the WEP keys in the other WLAN adapter(s).
- Enter the WEP keys manually.

  Your AG-220 allows you to configure up to four 64-bit, 128-bit or 256-bit WEP keys and only one key is used as the default key at any one time.

3.2.3.1.2 Authentication Type

The IEEE 802.11b/g standard describes a simple authentication method between the wireless stations and AP. Three authentication types are defined: **Auto**, **Open System** and **Shared Key**.

- Open System mode is implemented for ease-of-use and when security is not an issue. The wireless station and the AP or peer computer do not share a secret key. Thus the wireless stations can associate with any AP or peer computer and listen to any transmitted data that is not encrypted.
- Shared Key mode involves a shared secret key to authenticate the wireless station to the AP or peer computer. This requires you to enable the wireless LAN security and use same settings on both the wireless station and the AP or peer computer.
- Auto authentication mode allows the AG-220 to switch between the open system and shared key modes automatically. Use the auto mode if you do not know the authentication mode of the other wireless stations.

3.2.3.2 IEEE 802.1x

The IEEE 802.1x standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication can be done using an external RADIUS server.

3.2.3.2.1 EAP Authentication

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. The AG-220 supports EAP-TLS, EAP-TTLS and EAP-PEAP. Refer to Appendix D on page 115 for descriptions.

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). Certificates (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

3.2.3.3 WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

3.3 WiFi Protected Setup

Note: This feature is for Windows Vista only.

When using the Windows Vista ZyXEL utility your AG-220 supports WiFi Protected Setup (WPS), which is an easy way to set up a secure wireless network. WPS is an industry standard specification, defined by the WiFi Alliance.

WPS allows you to quickly set up a wireless network with strong security, without having to configure security settings manually. Each WPS connection works between two devices. Both devices must support WPS (check each device's documentation to make sure).

Depending on the devices you have, you can either press a button (on the device itself, or in its configuration utility) or enter a PIN (a unique Personal Identification Number that allows one device to authenticate the other) in each of the two devices. When WPS is activated on a device, it has two minutes to find another device that also has WPS activated. Then, the two devices connect and set up a secure network by themselves.

3.3.1 Push Button Configuration

WPS Push Button Configuration (PBC) is initiated by pressing a button on each WPS-enabled device, and allowing them to connect automatically. You do not need to enter any information.

Not every WPS-enabled device has a physical WPS button. Some may have a WPS PBC button in their configuration utilities instead of or in addition to the physical button.

Take the following steps to set up WPS using the button.

1. Ensure that the two devices you want to set up are within wireless range of one another.
2. Look for a WPS button on each device. If the device does not have one, log into its configuration utility and locate the button (see the device's User's Guide for how to do this - for the AG-220, see Section 4.7 on page 68).
3. Press the button on one of the devices (it doesn't matter which).
4. Within two minutes, press the button on the other device. The registrar sends the network name (SSID) and security key through an secure connection to the enrollee.

If you need to make sure that WPS worked, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

3.3.2 PIN Configuration

Each WPS-enabled device has its own PIN (Personal Identification Number). This may either be static (it cannot be changed) or dynamic (in some devices you can generate a new PIN by clicking on a button in the configuration interface).

Use the PIN method instead of the push-button configuration (PBC) method if you want to ensure that the connection is established between the devices you specify, not just the first two devices to activate WPS in range of each other. However, you need to log into the configuration interfaces of both devices to use the PIN method.

When you use the PIN method, you must enter the PIN from one device (usually the wireless client) into the second device (usually the Access Point or wireless router). Then, when WPS is activated on the first device, it presents its PIN to the second device. If the PIN matches, one device sends the network and security information to the other, allowing it to join the network.

Take the following steps to set up a WPS connection between an access point or wireless router (referred to here as the AP) and a client device using the PIN method.

1. Ensure WPS is enabled on both devices.
2. Access the WPS section of the AP's configuration interface. See the device's User's Guide for how to do this.
3. Look for the client's WPS PIN; it will be displayed either on the device, or in the WPS section of the client's configuration interface (see the device's User's Guide for how to find the WPS PIN - for the AG-220, see Section 3.3.1 on page 41).
4. Enter the client's PIN in the AP's configuration interface.

Note: If the client device's configuration interface has an area for entering another device's PIN, you can either enter the client's PIN in the AP, or enter the AP's PIN in the client - it does not matter which.

5. Start WPS on both devices within two minutes.

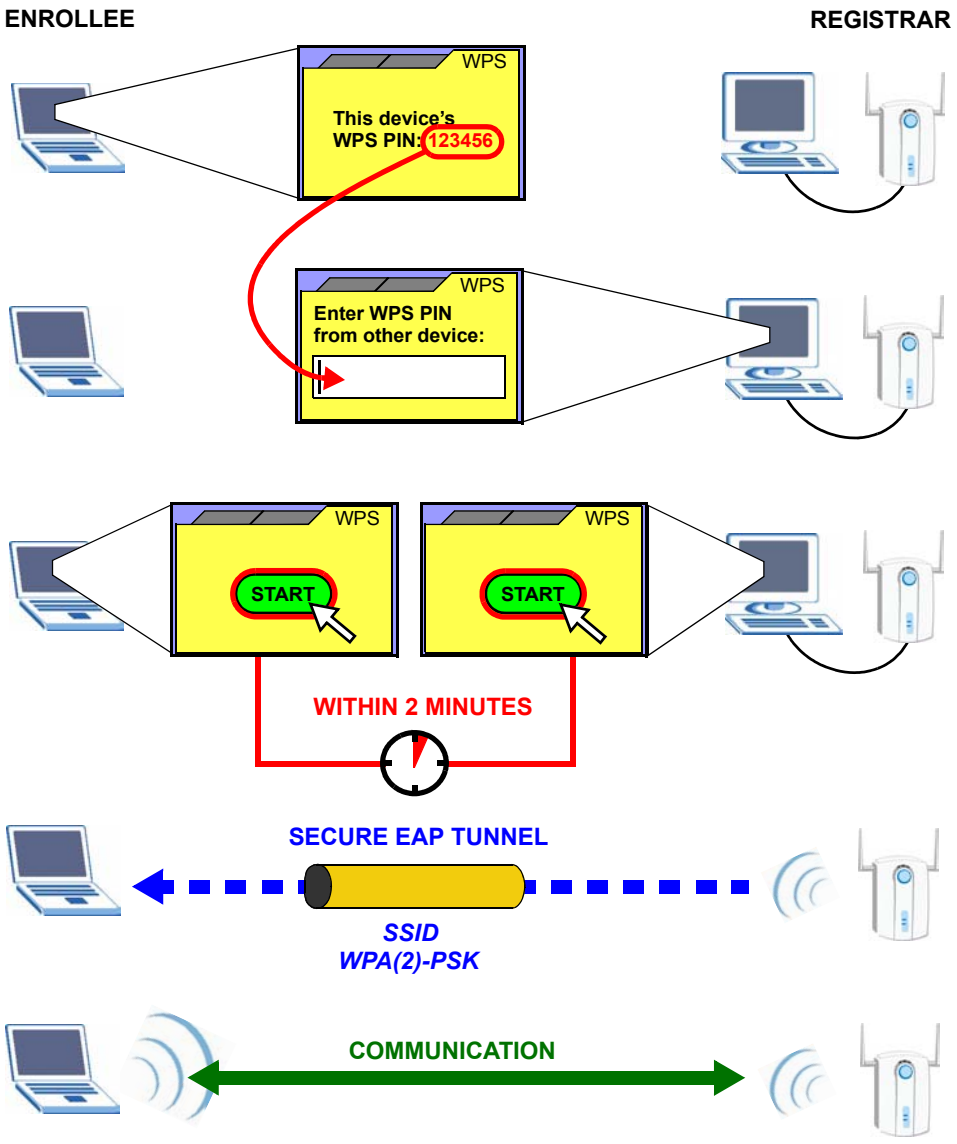
Note: Use the configuration utility to activate WPS, not the push-button on the device itself.

6. On a computer connected to the wireless client, try to connect to the Internet. If you can connect, WPS was successful.

   If you cannot connect, check the list of associated wireless clients in the AP's configuration utility. If you see the wireless client in the list, WPS was successful.

The following figure shows a WPS-enabled wireless client (installed in a notebook computer) connecting to the WPS-enabled AP via the PIN method.

Figure 21 Example WPS Process: PIN Method

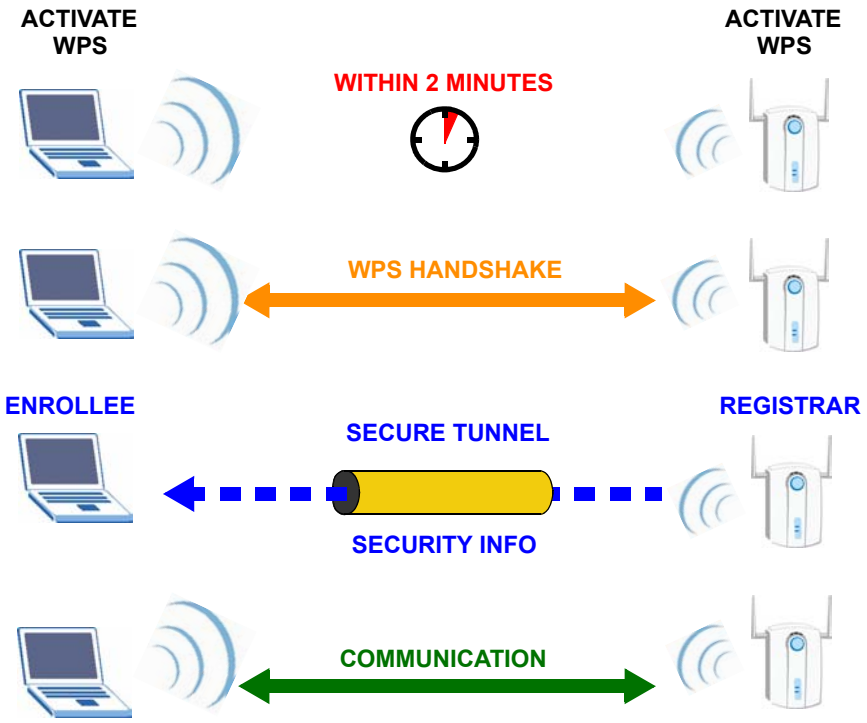


3.3.3 How WPS Works

When two WPS-enabled devices connect, each device must assume a specific role. One device acts as the registrar (the device that supplies network and security settings) and the other device acts as the enrollee (the device that receives network and security settings. The registrar creates a secure EAP (Extensible Authentication Protocol) tunnel and sends the network name (SSID) and the WPA-PSK or WPA2-PSK pre-shared key to the enrollee. Whether WPA-PSK or WPA2-PSK is used depends on the standards supported by the devices. If the registrar is already part of a network, it sends the existing information. If not, it generates the SSID and WPA(2)-PSK randomly.

The following figure shows a WPS-enabled client (installed in a notebook computer) connecting to a WPS-enabled access point.

Figure 22 How WPS works



The roles of registrar and enrollee last only as long as the WPS setup process is active (two minutes). The next time you use WPS, a different device can be the registrar if necessary.

The WPS connection process is like a handshake; only two devices participate in each WPS transaction. If you want to add more devices you should repeat the process with one of the existing networked devices and the new device.

Note that the access point (AP) is not always the registrar, and the wireless client is not always the enrollee. All WPS-certified APs can be a registrar, and so can some WPS-enabled wireless clients.

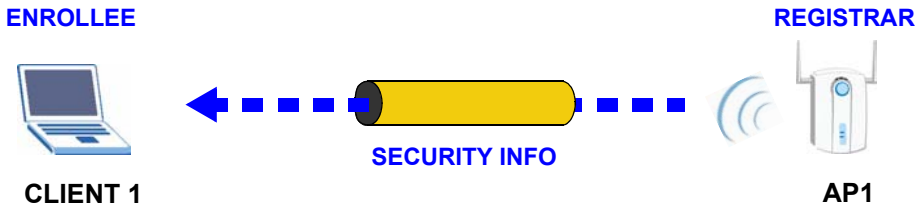
By default, a WPS devices is "unconfigured". This means that it is not part of an existing network and can act as either enrollee or registrar (if it supports both functions). If the registrar is unconfigured, the security settings it transmits to the enrollee are randomly-generated. Once a WPS-enabled device has connected to another device using WPS, it becomes "configured". A configured wireless client can still act as enrollee or registrar in subsequent WPS connections, but a configured access point can no longer act as enrollee. It will be the registrar in all subsequent WPS connections in which it is involved. If you want a configured AP to act as an enrollee, you must reset it to its factory defaults.

3.3.3.1 Example WPS Network Setup

This section shows how security settings are distributed in an example WPS setup.

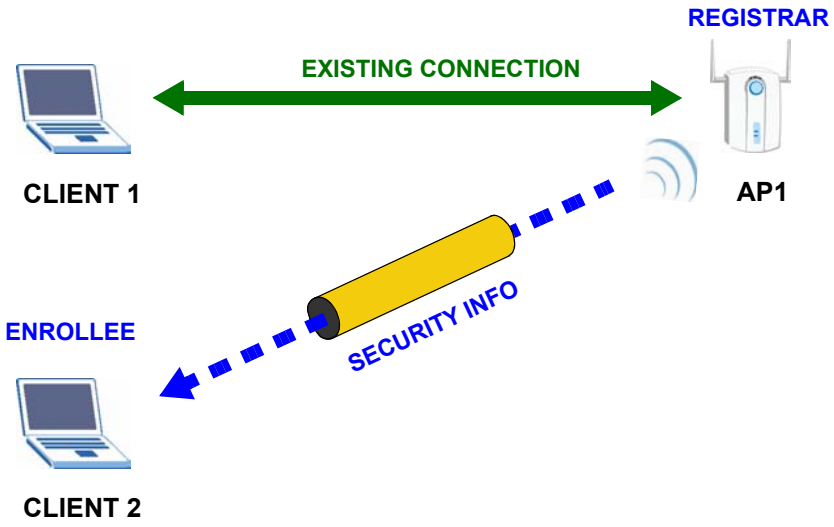
The following figure shows an example network. In step **1**, both **AP1** and **Client 1** are unconfigured. When WPS is activated on both, they perform the handshake. In this example, **AP1** is the registrar, and **Client 1** is the enrollee. The registrar randomly generates the security information to set up the network, since it is unconfigured and has no existing information.

Figure 23 WPS: Example Network Step 1



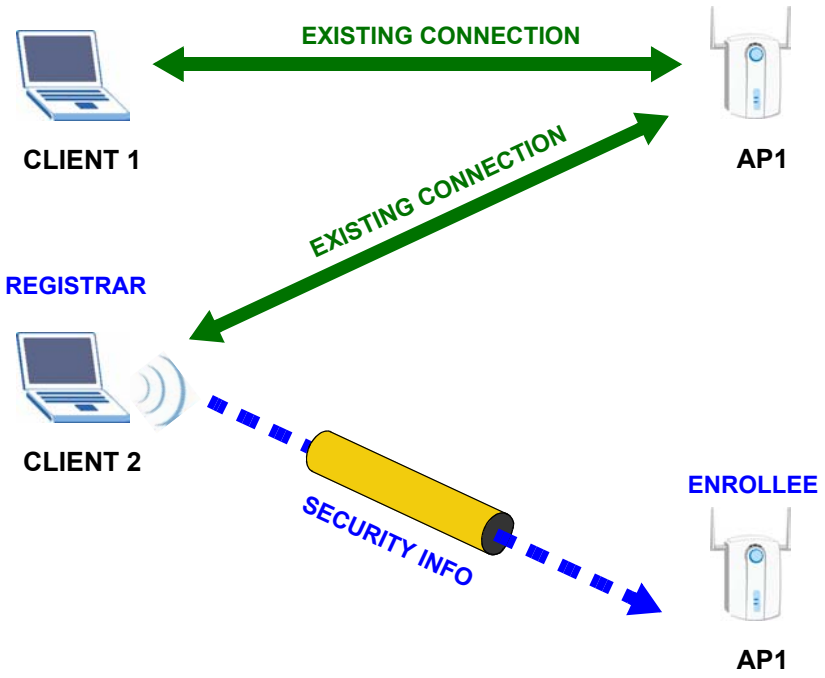
In step **2**, you add another wireless client to the network. You know that **Client 1** supports registrar mode, but it is better to use **AP1** for the WPS handshake with the new client since you must connect to the access point anyway in order to use the network. In this case, **AP1** must be the registrar, since it is configured (it already has security information for the network). **AP1** supplies the existing security information to **Client 2**.

Figure 24 WPS: Example Network Step 2



In step 3, you add another access point (**AP2**) to your network. **AP2** is out of range of **AP1**, so you cannot use **AP1** for the WPS handshake with the new access point. However, you know that **Client 2** supports the registrar function, so you use it to perform the WPS handshake instead.

Figure 25 WPS: Example Network Step 3



3.3.4 Limitations of WPS

WPS has some limitations of which you should be aware.

- WPS works in Infrastructure networks only (where an AP and a wireless client communicate). It does not work in Ad-Hoc networks (where there is no AP).
- When you use WPS, it works between two devices only. You cannot enroll multiple devices simultaneously, you must enroll one after the other.

  For instance, if you have two enrollees and one registrar you must set up the first enrollee (by pressing the WPS button on the registrar and the first enrollee, for example), then check that it successfully enrolled, then set up the second device in the same way.
- WPS works only with other WPS-enabled devices. However, you can still add non-WPS devices to a network you already set up using WPS.

  WPS works by automatically issuing a randomly-generated WPA-PSK or WPA2-PSK pre-shared key from the registrar device to the enrollee device. Whether the network uses WPA-PSK or WPA2-PSK depends on the device. You can check the configuration interface of the registrar device to discover the key the network is using (if the device supports this feature). Then, you can enter the key into the non-WPS device and join the network as normal (the non-WPS device must also support WPA-PSK or WPA2-PSK).
- When you use the PBC method, there is a short period (from the moment you press the button on one device to the moment you press the button on the other device) when any WPS-enabled device could join the network. This is because the registrar has no way of identifying the "correct" enrollee, and cannot differentiate between your enrollee and a rogue device. This is a possible way for a hacker to gain access to a network.

You can easily check to see if this has happened. WPS works between only two devices simultaneously, so if another device has enrolled your device will be unable to enroll, and will not have access to the network. If this happens, open the access point's configuration interface and look at the list of associated clients (usually displayed by MAC address). It does not matter if the access point is the WPS registrar, the enrollee, or was not involved in the WPS handshake; a rogue device must still associate with the access point to gain access to the network. Check the MAC addresses of your wireless clients (usually printed on a label on the bottom of the device). If there is an unknown MAC address you can remove it or reset the AP.

3.4 Introduction to OTIST

In a wireless network, the wireless clients must have the same SSID and security settings as the access point (AP) or wireless router (we will refer to both as "AP" here) in order to associate with it. Traditionally this meant that you had to configure the settings on the AP and then manually configure the exact same settings on each wireless client.

OTIST (One-Touch Intelligent Security Technology) allows you to transfer your AP's SSID and WEP or WPA-PSK security settings to wireless clients that support OTIST and are within transmission range. You can also choose to have OTIST generate a WPA-PSK key for you if you didn't configure one manually.

3.4.1 Enabling OTIST

You must enable OTIST on both the AP and wireless client before you start transferring settings.

We use the P-334U in this guide as the example AP. Screens may vary slightly for your ZyXEL devices.

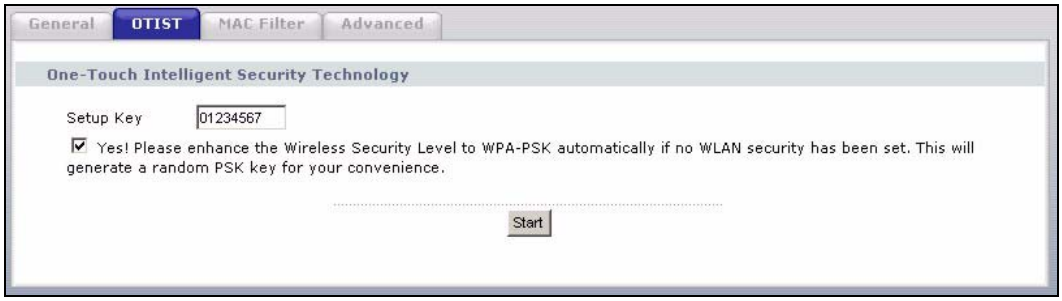
Note: The AP and wireless client(s) MUST use the same **Setup key**.

3.4.1.1 AP

On the P-334U, you can enable OTIST using the **OTIST** button or the web configurator. If you use the **OTIST** button, the default (01234567) or previous saved (through the web configurator) **Setup key** is used to encrypt the settings that you want to transfer.

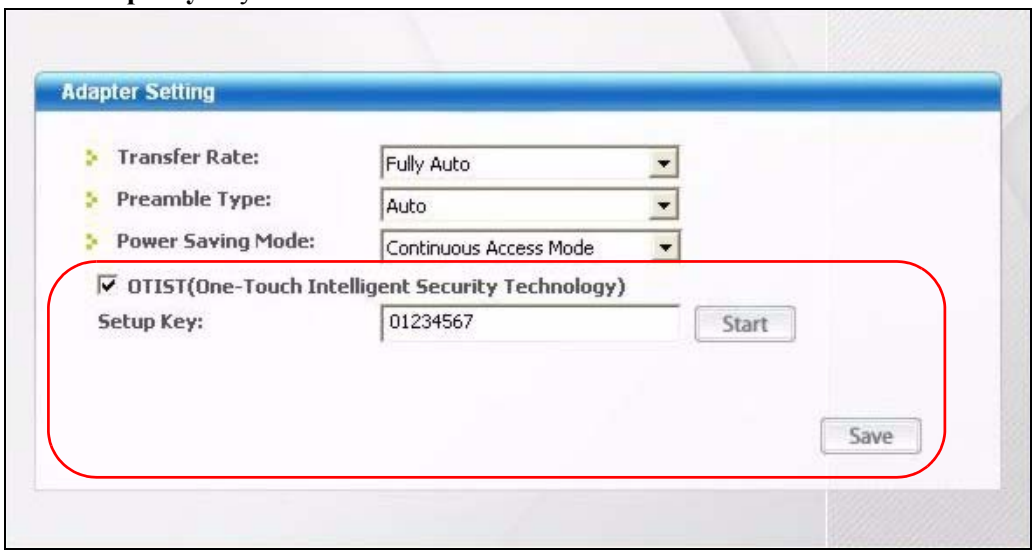
Hold in the **OTIST** button for about two seconds.

In the web configurator, go to the **Wireless LAN** main screen and then select **OTIST**. To change the **Setup key**, enter zero to eight printable characters. To have OTIST automatically generate a WPA-PSK key, select the **Yes!** check box. If you manually configured a WEP key or a WPA-PSK key and you also selected this check box, then the key you manually configured is used.



3.4.1.2 Wireless Client

Start the ZyXEL utility and click the **Adapter** tab. Select the **OTIST** check box, enter the same **Setup Key** as your AP and click **Save**.

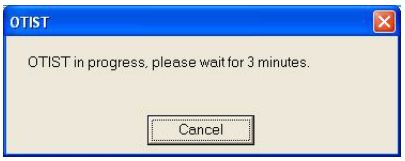


3.4.2 Starting OTIST

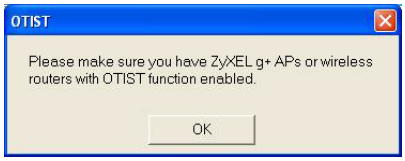
Note: You must click **Start** in the AP **OTIST** web configurator screen and in the wireless client(s) **Adapter** screen all within three minutes (at the time of writing). You can start OTIST in the wireless clients and AP in any order but they must all be within range and have OTIST enabled.

1 In the AP, a web configurator screen pops up showing you the security settings to transfer. After reviewing the settings, click **OK**.

2 This screen appears while OTIST settings are being transferred. It closes when the transfer is complete.



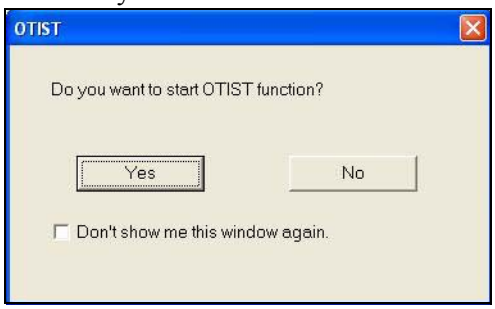
- In the wireless client, you see this screen if it can't find an OTIST-enabled AP (with the same **Setup key**). Click **OK** to go back to the ZyXEL utility main screen.



- If there is more than one OTIST-enabled AP within range, you see a screen asking you to select one AP to get settings from.

3.4.3 Notes on OTIST

1 If you enabled OTIST in the wireless client, you see this screen each time you start the utility. Click **Yes** for it to search for an OTIST-enabled AP.



2 If an OTIST-enabled wireless client loses its wireless connection for more than ten seconds, it will search for an OTIST-enabled AP for up to one minute. (If you manually have the wireless client search for an OTIST-enabled AP, there is no timeout; click **Cancel** in the OTIST progress screen to stop the search.)

3 When the wireless client finds an OTIST-enabled AP, you must still click **Start** in the AP **OTIST** web configurator screen or hold in the **Reset** button (for one or two seconds) for the AP to transfer settings.

4 If you change the SSID or the keys on the AP after using OTIST, you need to run OTIST again or enter them manually in the wireless client(s).

5 If you configure OTIST to generate a WPA-PSK key, this key changes each time you run OTIST. Therefore, if a new wireless client joins your wireless network, you need to run OTIST on the AP and ALL the wireless clients again.

CHAPTER 4
Wireless Station Mode Configuration

This chapter shows you how to configure your AG-220 in wireless station mode. See Chapter 5 on page 73 for how to configure the AG-220 in access point mode.

4.1 Wireless Station Mode Overview

To set your AG-220 to wireless station mode, select **Station Mode** in any utility screen (refer to Section 1.2.3 on page 25).

4.1.1 ZyXEL Utility Screen Summary

This section describes the ZyXEL utility screens when the AG-220 is in station mode.

Figure 26 ZyXEL Utility Menu Summary: Station Mode

The following table describes the menus.

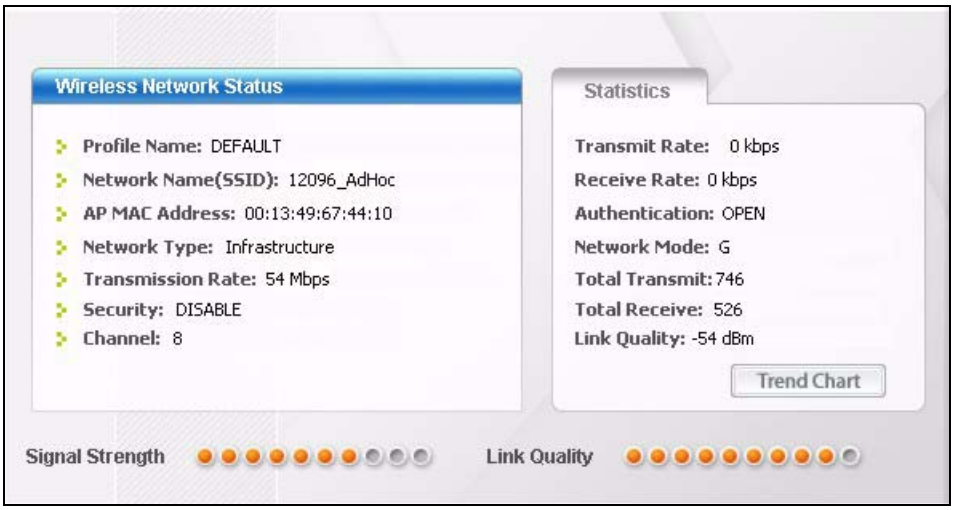
Table 2 ZyXEL Utility Menu Summary: Station Mode

TAB	DESCRIPTION
Station Mode	
Link Info	Use this screen to see your current connection status, configuration and data rate statistics.
Site Survey	Use this screen to • scan for a wireless network • configure wireless security (if activated on the selected network). • connect to a wireless network.
Profile	Use this screen to add, delete, edit or activate a profile with a set of wireless and security settings.
Advanced	Use this screen to change the wireless network mode.
Adapter	Use this screen to configure a transfer rate, enable power saving and use OTIST (One-Touch Intelligent Security Technology).

4.2 The Link Info Screen

When the ZyXEL utility starts, the **Link Info** screen displays, showing the current configuration and connection status of your AG-220.

Figure 27 Station Mode: Link Info



The following table describes the labels in this screen.

Table 3 Station Mode: Link Info

LABEL	DESCRIPTION
AP Mode Station Mode	Use the check box to set the AG-220 to operate in wireless station or access point mode. Refer to Section 1.2.3 on page 25 for more information.
Wireless Network Status	
Profile Name	This is the name of the profile you are currently using.
Network Name (SSID)	The SSID identifies the wireless network to which a wireless station is associated. This field displays the name of the wireless device to which the AG-220 is associated.
AP MAC Address	This field displays the MAC address of the AP or peer computer to which the AG-220 is associated.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the wireless network.
Transmission Rate	This field displays the current transmission rate of the AG-220 in megabits per second (Mbps).
Security	This field displays whether data encryption is activated (**WEP** (WEP or 802.1x), **TKIP** (WPA/WPA-PSK/WPA2/WPA2-PSK), **AES** (WPA/WPA-PSK/WPA2/WPA2-PSK)) or inactive (**DISABLE**).
Channel	This field displays the radio channel the AG-220 is currently using.
Statistics	
Transmit Rate	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive Rate	This field displays the current data receiving rate in kilobits per second (Kbps).

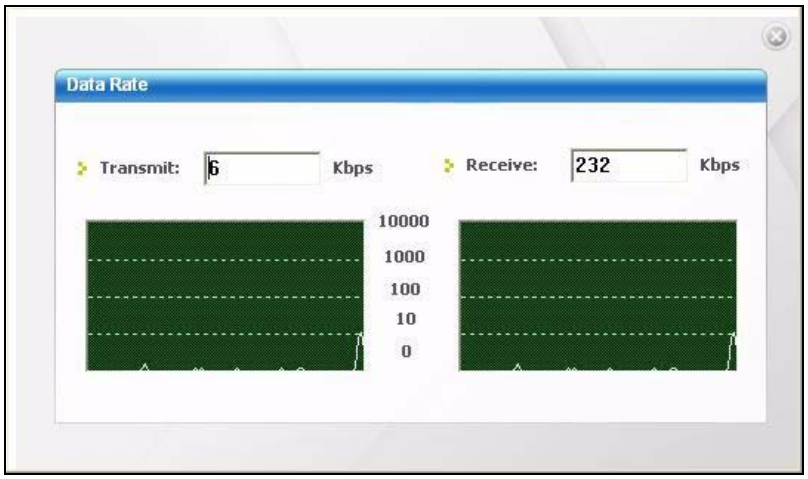
Table 3 Station Mode: Link Info (continued)

LABEL	DESCRIPTION
Authentication	This field displays the authentication method of the AG-220.
Network Mode	This field displays the wireless standard (**A**, **B** or **G**) of the AP or peer computer.
Total Transmit	This field displays the total number of data frames transmitted.
Total Receive	This field displays the total number of data frames received.
Link Quality	This field displays the signal strength of the AG-220.
Trend Chart	Click this button to display the real-time statistics of the data rate in kilobits per second (Kbps).
Signal Strength	The status bar shows the strength of the signal. The signal strength mainly depends on the antenna output power and the distance between your AG-220 and the AP or peer computer.
Link Quality	The status bar shows the quality of wireless connection. This refers to the percentage of packets transmitted successfully. If there are too many wireless stations in a wireless network, collisions may occur which could result in a loss of messages even though you have high signal strength.

4.2.1 Trend Chart

Click **Trend Chart** in the **Link Info** screen to display a screen as shown below. Use this screen to view real-time data traffic statistics.

Figure 28 Station Mode: Link Info: Trend Chart



The following table describes the labels in this screen.

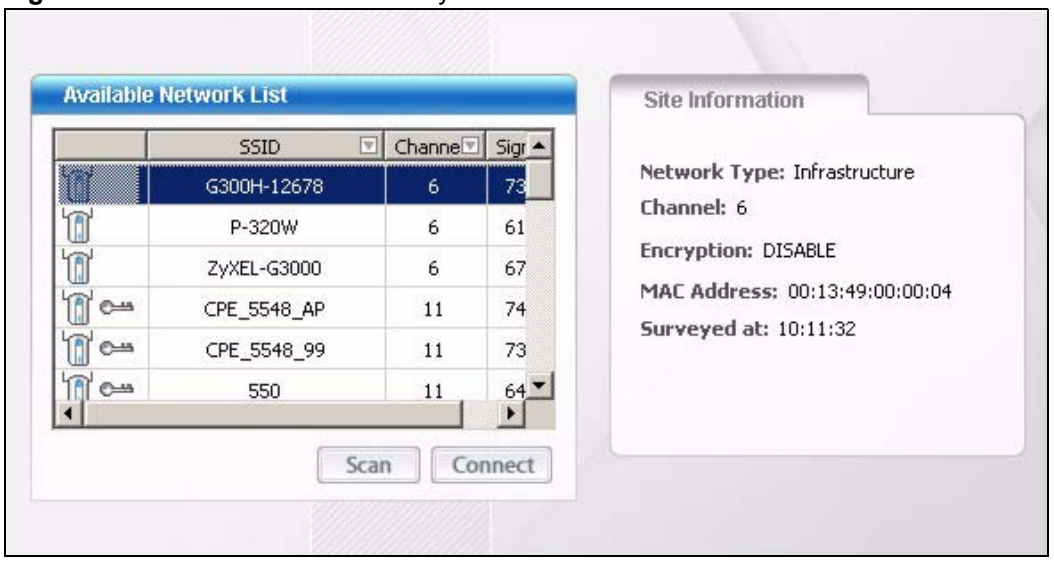
Table 4 Station Mode: Link Info: Trend Chart

LABEL	DESCRIPTION
Transmit	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive	This field displays the current data receiving rate in kilobits per second (Kbps).

4.3 The Site Survey Screen

Use the **Site Survey** screen to scan for and connect to a wireless network automatically.

Figure 29 Station Mode: Site Survey



The following table describes the labels in this screen.

Table 5 Station Mode: Site Survey

LABEL	DESCRIPTION
Available Network List	Click a column heading to sort the entries.
, , or	denotes that the wireless device is in infrastructure mode and the wireless security is activated. denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set IDentifier) of each wireless device.
Channel	This field displays the channel number used by each wireless device.
Signal	This field displays the signal strength of each wireless device.
Scan	Click **Scan** to search for available wireless devices within transmission range.
Connect	Click **Connect** to associate to the selected wireless device.
Site Information	Click an entry in the **Available Network List** table to display the information of the selected wireless device.
Network Type	This field displays the network type (**Infrastructure** or **Ad Hoc**) of the wireless device.
Channel	This field displays the channel number used by each wireless device.
Encryption	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).

Table 5 Station Mode: Site Survey (continued)

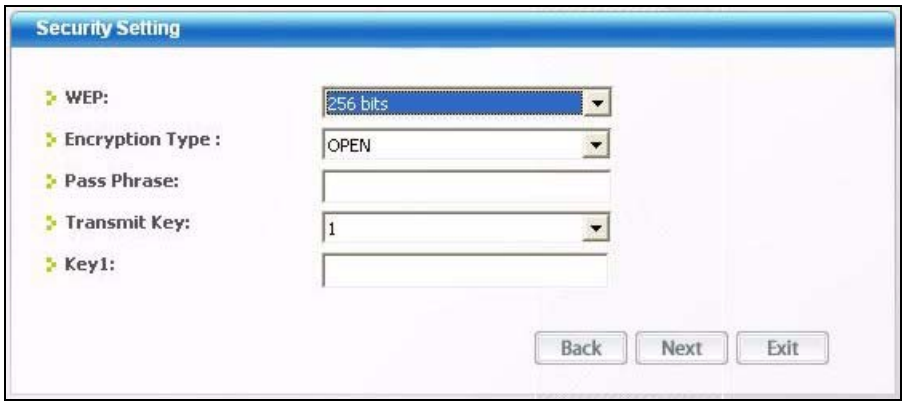
LABEL	DESCRIPTION
MAC address	This field displays the MAC address of the wireless device.
Surveyed at	This field displays the time when the wireless device was scanned.

4.3.1 Security Settings

When you configure the AG-220 to connect to a network with wireless security activated and the security settings are disabled on the AG-220, the screen varies according to the encryption method used by the selected network.

4.3.1.1 WEP Encryption

Figure 30 Station Mode: Security Setting: WEP



The following table describes the labels in this screen.

Table 6 Station Mode: Security Setting: WEP

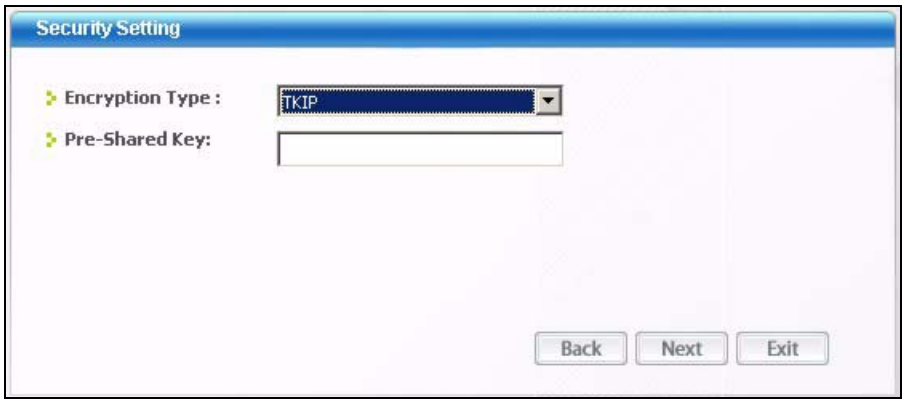
LABEL	DESCRIPTION
Security Settings	
WEP	Select **64 Bits**, **128 Bits** or **256 Bits** to activate WEP encryption and then fill in the related fields.
Encryption Type	Select an authentication method. Choices are **SHARED** and **OPEN**. Refer to Section 3.2.3.1.2 on page 39 for more information.
Pass Phrase	Enter a passphrase of up to 63 case-sensitive printable characters. As you enter the passphrase, the AG-220 automatically generates four different WEP keys and displays it in the key field below. Refer to Section 3.2.3.1.1 on page 39 for more information. At the time of writing, you cannot use the passphrase function to generate 256-bit WEP keys.
Transmit Key	Select a default WEP key to use for data encryption. The key displays in the field below.

Table 6 Station Mode: Security Setting: WEP (continued)

LABEL	DESCRIPTION
Key x (where x is a number between 1 and 4)	Select this option if you want to manually enter the WEP keys. Enter the WEP key in the field provided. If you select **64 Bits** in the **WEP** field. Enter either 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 11AA22BB33) for HEX key type. or Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for ASCII key type. If you select **128 Bits** in the **WEP** field, Enter either 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 00112233445566778899AABBCC) for HEX key type or Enter 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey12345678) for ASCII key type. If you select **256 Bits** in the **WEP** field, Enter either 58 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 0000111122223333444455556666777788889999AAAABBBBCCCC000011) for HEX key type or Enter 29 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey11112222333334444555566 78) for ASCII key type. **Note:** The values for the WEP keys must be set up exactly the same on all wireless devices in the same wireless LAN. ASCII WEP keys are case sensitive.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 60.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.2 WPA-PSK/WPA2-PSK

Figure 31 Station Mode: Security Setting: WPA-PSK/WPA2-PSK



The following table describes the labels in this screen.

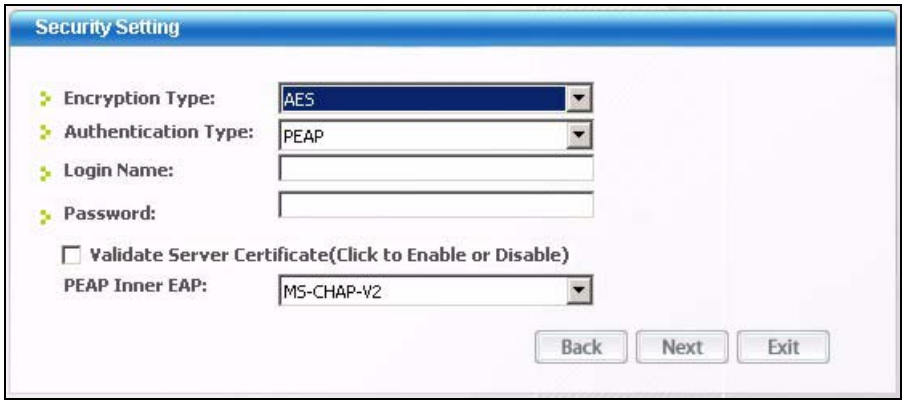
Table 7 Station Mode: Security Setting: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (**TKIP** or **AES**) for data encryption. Refer to Section 3.2.3.3 on page 40 for more information.
Pre-Shared Key	Type a pre-shared key (same as the AP or peer device) of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols) or 64 hexadecimal characters.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 60.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.3 WPA/WPA2

Note: At the time of writing **Login Name** and **Password** are not available on Windows Vista.

Figure 32 Station Mode: Security Settings: WPA/WPA2



The following table describes the labels in this screen.

Table 8 Station Mode: Security Setting: WPA/WPA2

LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (**TKIP** or **AES**) for data encryption. Refer to Section 3.2.3.3 on page 40 for more information.
Authentication Type	The type of authentication you use depends on the RADIUS server or AP. Select an authentication method from the drop down list. Options are **TLS** and **PEAP**.

Table 8 Station Mode: Security Setting: WPA/WPA2

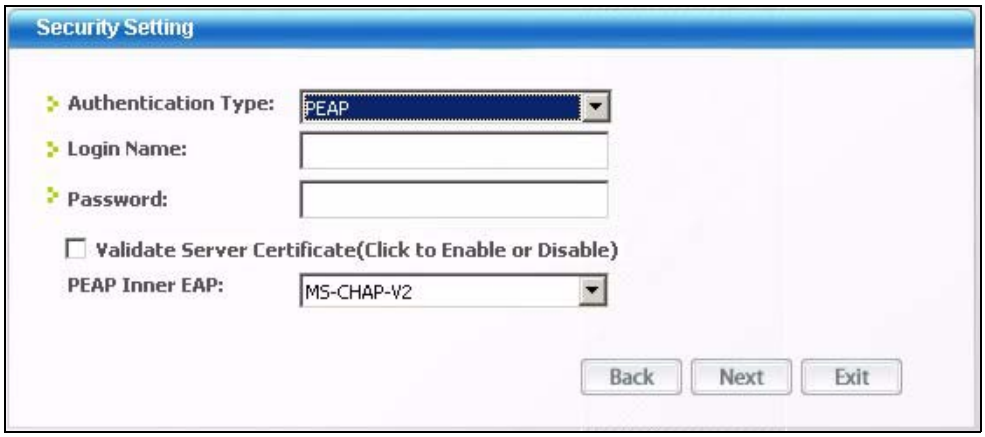
LABEL	DESCRIPTION
Login Name	Enter a user name. This is the user name that you or an administrator set up on a RADIUS server. **Note:** At the time of writing this field is not available on Windows Vista.
Password	This field is not available when you select **TLS** in the **Authentication Type** field. Enter the password associated with the user name above. **Note:** At the time of writing this field is not available on Windows Vista.
Certificate	This field is only available when you select **TLS** in the **Authentication Type** field. Click **Browse** to select a certificate. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
Validate Server Certificate	Select the check box to check the certificate of the authentication server.
PEAP Inner EAP	This field is only available when you select **PEAP** in the **Authentication Type** field. The PEAP method used by the RADIUS server or AP for client authentication is **MS CHAP v2**.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 60.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.1.4 IEEE 802.1x

Configure IEEE 802.1x security with various authentication methods in this screen.

Note: At the time of writing **Login Name** and **Password** are not available on Windows Vista.

Figure 33 Station Mode: Security Setting: 802.1x



The following table describes the labels in this screen.

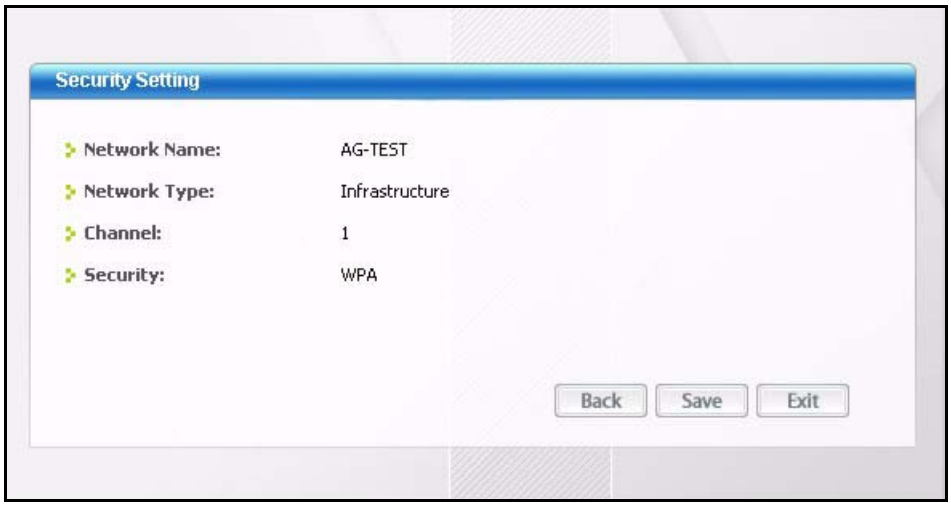
Table 9 Station Mode: Security Settings: IEEE 802.1x

LABEL	DESCRIPTION
Authentication Type	The type of authentication you use depends on the RADIUS server or AP. Select an authentication method from the drop down list. Options are **TLS** and **PEAP**.
Login Name	Enter a user name. This is the user name that you or an administrator set up on a RADIUS server. **Note:** At the time of writing this field is not available on Windows Vista.
Password	This field is not available when you select **TLS** in the **Authentication Type** field. Enter the password associated with the user name above. **Note:** At the time of writing this field is not available on Windows Vista.
Certificate	This field is only available when you select **TLS** in the **Authentication Type** field. Click **Browse** to select a certificate. **Note:** You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
Validate Server Certificate	Select the check box to check the certificate of the authentication server.
PEAP Inner EAP	This field is only available when you select **PEAP** in the **Authentication Type** field. The PEAP method used by the RADIUS server or AP for client authentication is **MS CHAP v2**.
Back	Click **Back** to go to the **Site Survey** screen to select and connect to another network.
Next	Click **Next** to confirm your selections and advance to the **Confirm Save** screen. Refer to Section 4.3.2 on page 60.
Exit	Click **Exit** to return to the **Site Survey** screen without saving.

4.3.2 Confirm Save Screen

Use this screen to confirm and save the security settings.

Figure 34 Confirm Save Screen



The following table describes the labels in this screen.

Table 10 Confirm Save Screen

LABEL	DESCRIPTION
Security Setting	
Network Name	This field displays the **SSID** previously entered.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the wireless device.
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).
Back	Click **Back** to return to the previous screen.
Save	Click **Save** to save the changes back to the AG-220 and display the **Link Info** screen.
Exit	Click **Exit** to discard changes and return to the **Site Survey** screen.

4.4 The Profile Screen

A profile is a set of wireless parameters that you need to connect to a wireless network. With a profile activated, each time you start the AG-220, it automatically scans for the specific SSID and joins that network with the pre-defined wireless security settings. If the specified network is not available, the AG-220 cannot connect to a network.

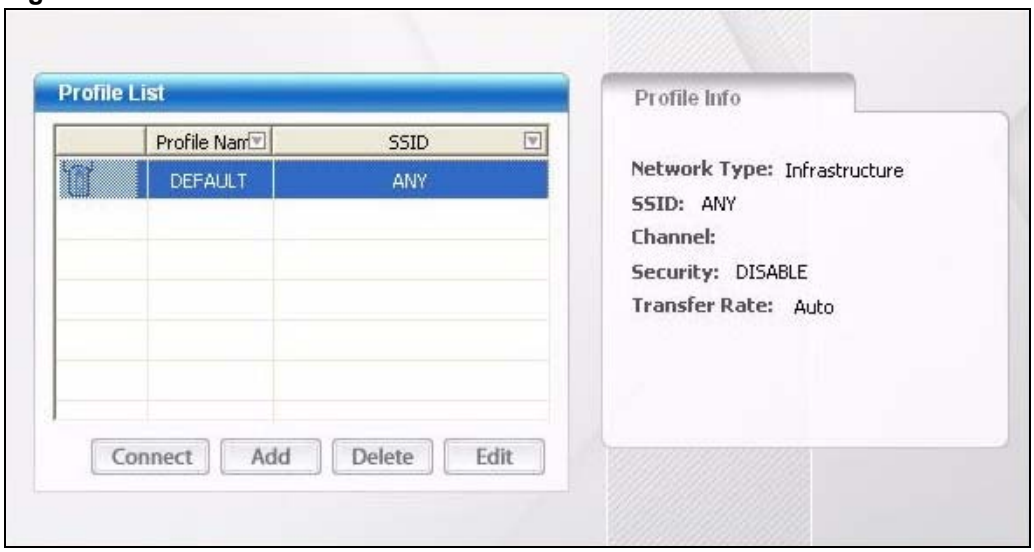
If you do not configure and activate a profile, each time you start the AG-220, the AG-220 uses the default profile to connect to any available network that has no security enabled.

The default profile is a profile that allows you to connect to any SSID that has no security enabled.

Click the **Profile** tab in the ZyXEL utility program to display the **Profile** screen as shown next.

The profile function allows you to save the wireless network settings in this screen, or use one of the pre-configured network profiles.

Figure 35 Station Mode: Profile



The following table describes the labels in this screen.

Table 11 Station Mode: Profile

LABEL	DESCRIPTION
Profile List	Click a column heading to sort the entries.
, , or	denotes that the wireless device is in infrastructure mode and the wireless security is activated. denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
Profile Name	This is the name of the pre-configured profile.
SSID	This is the SSID of the wireless network to which the selected profile associate.
Connect	To use and activate a previously saved network profile, select a pre-configured profile name in the table and click **Connect**.
Add	To add a new profile into the table, click **Add**.
Delete	To delete an existing wireless network configuration, select a profile in the table and click **Delete**.
Edit	To edit an existing wireless network configuration, select a profile in the table and click **Edit**.
Profile Info	The following fields display detailed information of the selected profile in the **Profile List** table.
Network Type	This field displays the network type (**Infrastructure** or **Ad-Hoc**) of the profile.

Table 11 Station Mode: Profile (continued)

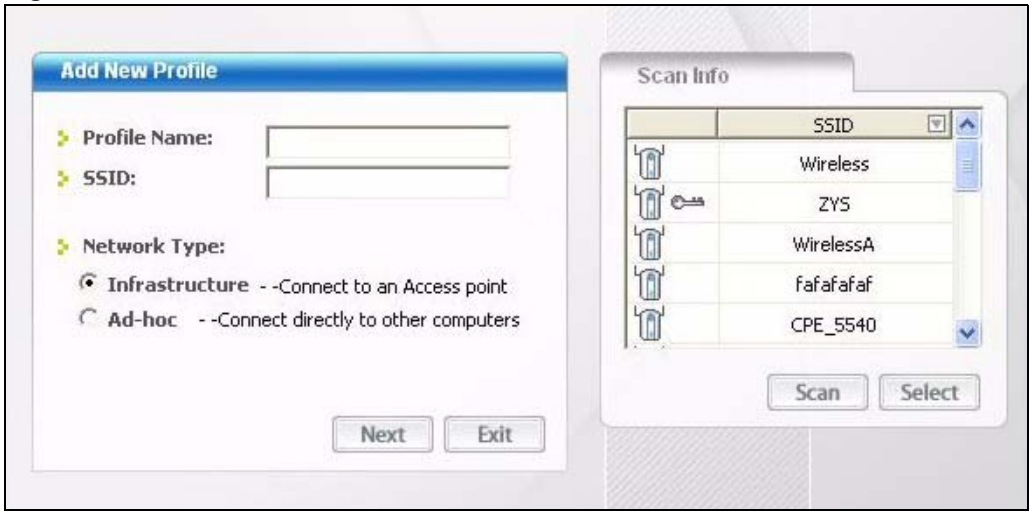
LABEL	DESCRIPTION
SSID	This field displays the SSID (Service Set IDentifier) of the profile.
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (**WEP** (WEP or 802.1x), **WPA**, **WPA-PSK**, **WPA2**, **WPA2-PSK**) or inactive (**DISABLE**).
Transfer Rate	This field displays the transmission speed of the selected profile in megabits per second (Mbps).

4.4.1 Adding a New Profile

Follow the steps below to add a new profile.

1 Click **Add** in the **Profile** screen. An **Add New Profile** screen displays as shown next. Click **Next** to continue.

Figure 36 Station Mode: Profile: Add a New Profile



The following table describes the labels in this screen.

Table 12 Station Mode: Profile: Add a New Profile

LABEL	DESCRIPTION
Add New Profile	
Profile Name	Enter a descriptive name in this field.
SSID	Select an available wireless device in the **Scan Info** table and click **Select**, or enter the SSID of the wireless device to which you want to associate in this field manually. Otherwise, enter **Any** to have the AG-220 associate to any AP or roam between any infrastructure wireless networks.
Network Type	Select **Infrastructure** to associate to an AP. Select **Ad-Hoc** to associate to a peer computer.
Next	Click **Next** to go to the next screen.
Exit	Click **Exit** to go back to the previous screen without saving.

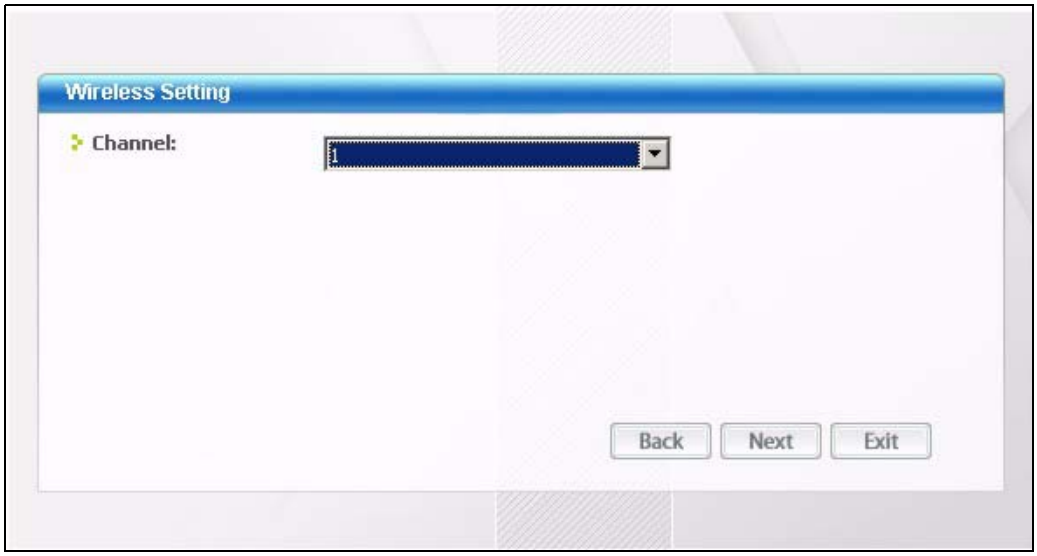
Table 12 Station Mode: Profile: Add a New Profile (continued)

LABEL	DESCRIPTION
Scan Info	This table displays the information of the available wireless networks within the transmission range.
, , or	denotes that the wireless device is in infrastructure mode and the wireless security is activated. denotes that the wireless device is in infrastructure mode but the wireless security is deactivated. denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated. denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set IDentifier) of each AP or peer device.
Scan	Click **Scan** to search for available wireless devices within transmission range.
Select	Select an available wireless device in the table and click **Select** to add it to this profile. Whenever you activate this profile, the AG-220 associates to the selected wireless network only.

2 If you select the **Infrastructure** network type in the previous screen, skip to step 3. If you select the **Ad-Hoc** network type in the previous screen, a screen displays as follows. Select a channel number and click **Next** to continue. If you are using Windows Vista this screen will not display, skip to step 3.

Note: To associate to an ad-hoc network, you must use the same channel as the peer computer.

Figure 37 Station Mode: Profile: Select a Channel



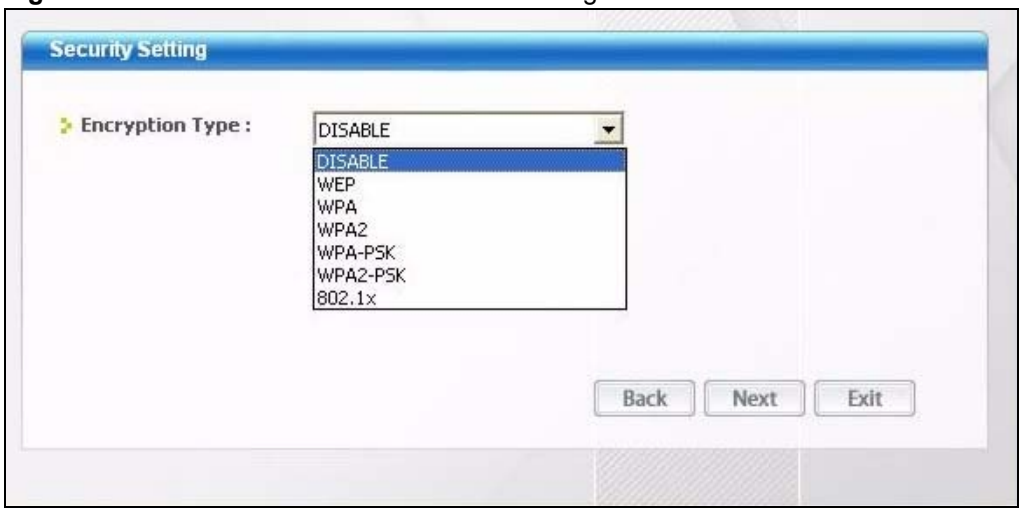
The following table describes the labels in this screen.

Table 13 Station Mode: Profile: Select a Channel

LABEL	DESCRIPTION
Wireless Settings	
Channel	Select a channel number from the drop-down list box. To associate to an ad-hoc network, you must use the same channel as the peer computer.

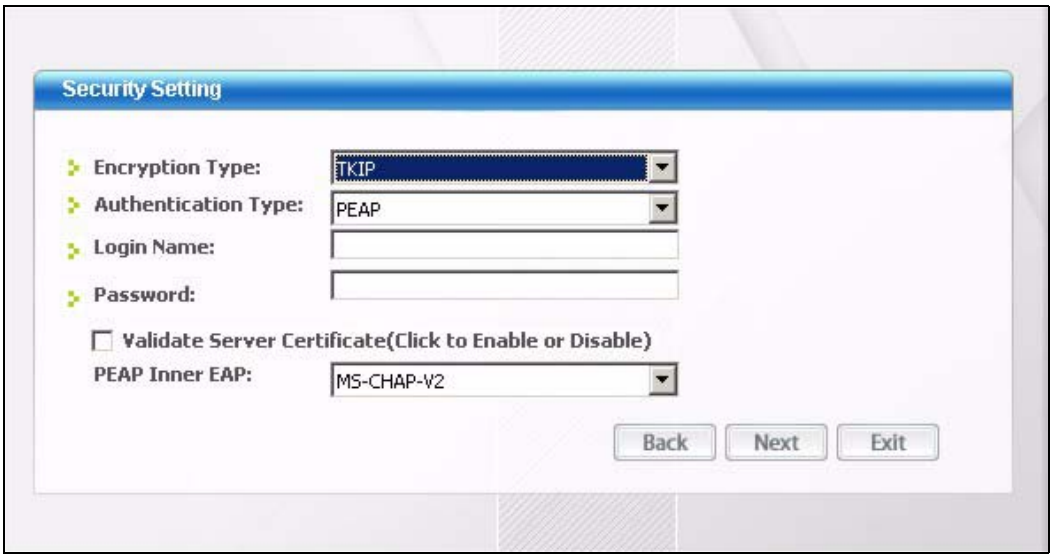
3 If you selected **Infrastructure** network type in the first screen, select **WEP**, **WPA**, **WPA2**, **WPA-PSK**, **WPA2-PSK** or **802.1x** from the drop-down list box to enable data encryption. If you selected **Ad-Hoc** network type in the first screen, you can only use **WEP** encryption method. Otherwise, select **DISABLE** to allow the AG-220 to communicate with the access points or other peer wireless computers without any data encryption, and skip to step 5.

Figure 38 Station Mode: Profile: Wireless Settings



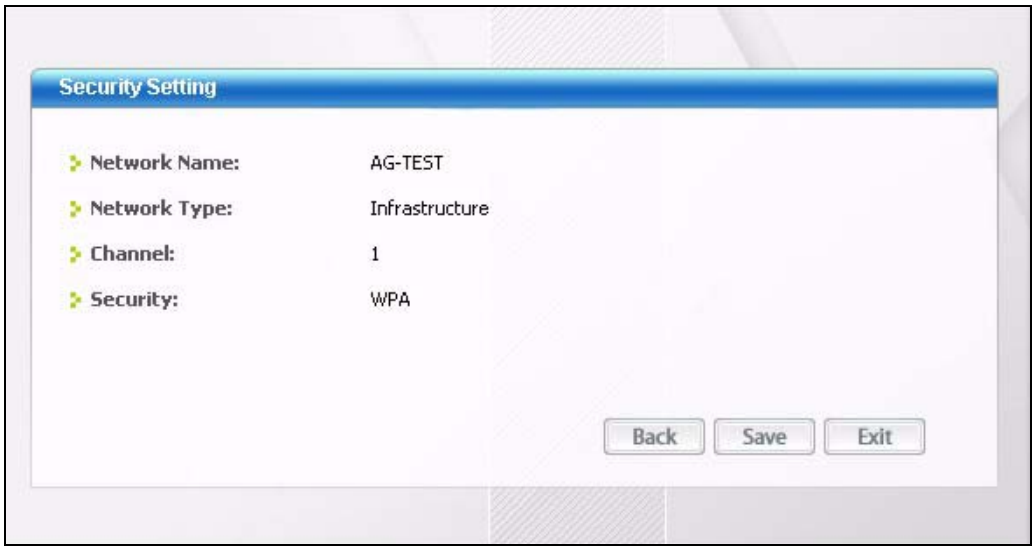
4 The screen varies depending on the encryption method you select in the previous screen. The settings must be exactly the same on the APs or other peer wireless computers as they are on the AG-220. Refer to Section 4.3.1 on page 55 for detailed information on wireless security configuration.

Figure 39 Station Mode: Profile: Security Settings



5 This read-only screen shows a summary of the new profile settings. Verify that the settings are correct. Click **Save** to save and go to the next screen. Click **Back** to return to the previous screen. Otherwise, click **Exit** to go back to the **Profile** screen without saving.

Figure 40 Station Mode: Profile: Confirm New Settings



6 To use this network profile, click the **Activate Now** button. Otherwise, click the **Activate Later** button. You can activate only one profile at a time.

Note: Once you activate a profile, the ZyXEL utility will use that profile the next time it is started.

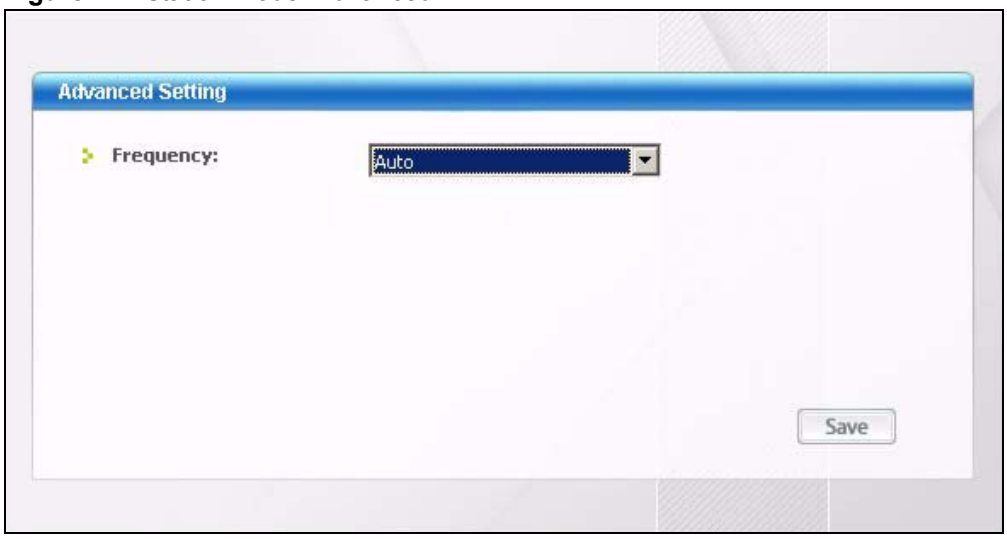
Figure 41 Station Mode: Profile: Activate the Profile

4.5 The Advanced Screen

To set the network mode of the AG-220, click the **Advanced** tab.

Note: This screen is not available in Windows Vista.

Figure 42 Station Mode: Advanced



The following table describes the labels in this screen.

Table 14 Station Mode: Advanced

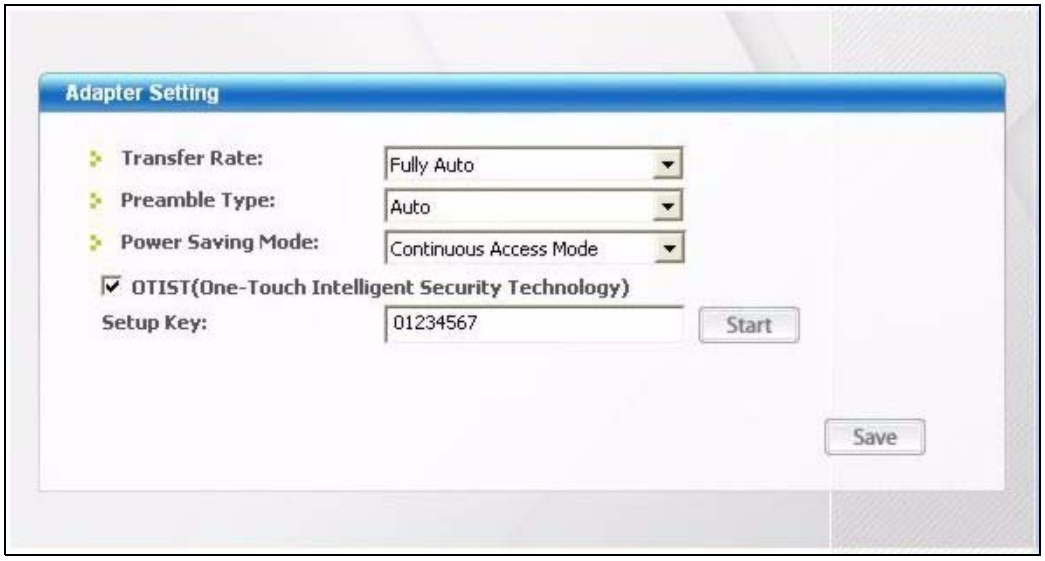
LABEL	DESCRIPTION
Advanced Setting	
Frequency	Choose a network mode. Select **Auto** (default) to have your AG-220 automatically connect to other wireless devices in IEEE 802.11a, b or g modes. Select **11a** to have your AG-220 connect to other wireless devices in IEEE 802.11a mode only, or **11b+11g** to have your AG-220 connect to other wireless devices in IEEE 802.11b and 802.11g modes only.
Save	Click **Save** to save the changes to the AG-220. If you are connected to a wireless network when changing network modes, the AG-220 will disconnect and then attempt to reestablish the connection using the new setting.

4.6 The Adapter Screen

To set the other advanced features on the AG-220, click the **Adapter** tab.

Note: This screen is different in Windows Vista. Please refer to Section 4.7 on page 68 for the Windows Vista screen.

Figure 43 Station Mode: Adapter



The following table describes the labels in this screen.

Table 15 Station Mode: Adapter

LABEL	DESCRIPTION
Adapter Setting	
Transmission Rate	In most networking scenarios, the factory default **Fully Auto** setting is the most efficient and allows your AG-220 to operate at the highest possible transmission (data) rate. If you want to select a specific transmission rate, select one that the AP or peer wireless device supports. **Note:** With USB 1.0/1.1, the AG-220 can only transmit at up to 11Mbps.
Preamble Type	Preamble is used to signal that data is coming to the receiver. Select the preamble type that the AP uses. **Short** preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11b/g compliant wireless adapters support **Long** preamble, but not all support short preamble. Select **Auto** to have the AG-220 automatically use short preamble when all access point or wireless stations support it; otherwise the AG-220 uses long preamble. **Note:** The AG-220 and the access point or wireless stations MUST use the same preamble mode in order to communicate.

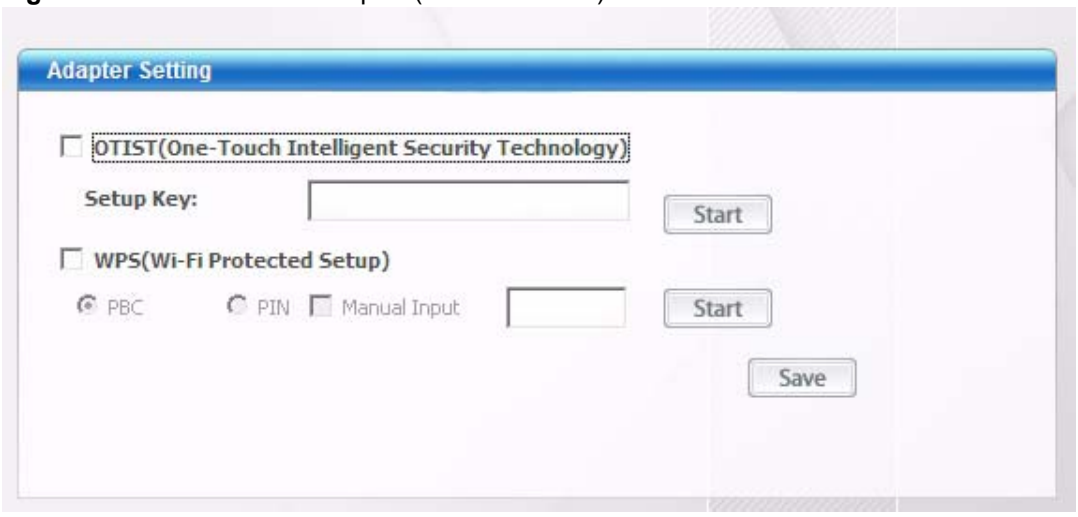
Table 15 Station Mode: Adapter (continued)

LABEL	DESCRIPTION
Power Saving Mode	Select **Maximum Power Save** or **Fast Power Save** to save power (especially for notebook computers). This forces the AG-220 to go to sleep mode when it is not transmitting data. When you select **Continuous Access Mode**, the AG-220 will never go to sleep mode.
OTIST (One-Touch Intelligent Security Technology)	Select this check box to enable OTIST.
Setup Key	Enter the same setup key (up to eight printable characters) as the ZyXEL AP or wireless router to which you want to associate. The default OTIST setup key is "01234567". **Note:** If you change the OTIST setup key on the ZyXEL AP or wireless router, you must also make the same change here.
Start	Click **Start** to encrypt the wireless security data using the setup key and have the ZyXEL AP or wireless router set your AG-220 to use the same wireless settings as the ZyXEL AP or wireless router. You must also activate and start OTIST on the ZyXEL AP or wireless router all within three minutes. See Section 3.4 on page 47 for more information.
Save	Click **Save** to save the changes to the AG-220 and return to the **Link Info** screen.

4.7 The Adapter Screen (Windows Vista)

This screen is only available in the Windows Vista version of the utility. To set the other advanced features on the AG-220, click the **Adapter** tab.

Figure 44 Station Mode: Adapter (Windows Vista)



The following table describes the labels in this screen.

Table 16 Station Mode: Adapter (Windows Vista)

LABEL	DESCRIPTION
Adapter Setting	
OTIST (One-Touch Intelligent Security Technology)	Select this check box to enable OTIST.
Setup Key	Enter the same setup key (up to eight printable characters) as the ZyXEL AP or wireless router to which you want to associate. The default OTIST setup key is "01234567". **Note:** If you change the OTIST setup key on the ZyXEL AP or wireless router, you must also make the same change here.
Start	Click **Start** to encrypt the wireless security data using the setup key and have the ZyXEL AP or wireless router set your AG-220 to use the same wireless settings as the ZyXEL AP or wireless router. You must also activate and start OTIST on the ZyXEL AP or wireless router all within three minutes.
WPS (Wi-Fi Protected Setup)	Select this to enable Wi-fi Protected Setup on the AG-220.
PBC	Select this to use the PBC (Push-Button Configuration) WPS mode. When you use the PBC mode you do not use a PIN.
PIN	Select this to use the PIN (Personal Identification Number) WPS mode. Use this option when you want to enter the AG-220's PIN in another WPS-enabled device. The PIN will be displayed in the field on the right. Click PIN again to generate a new PIN.
Manual Input	Select this check box to manually enter the PIN into the field on the right. This could be a PIN from another WPS-enabled device or a PIN you will type into the other WPS-enabled device.
Start	Click **Start** once you have selected the PBC or PIN settings. A screen will appear that states the WPS is in progress. You must now start WPS on the other WPS-enabled device within two minutes or the connection will time out. If the two WPS devices connect you will receive a successful connection message.
Save	Click **Save** to save the changes back to the AG-220 and return to the **Link Info** screen.

4.8 Security Settings in Windows Vista

When you use the AG-220 in Windows Vista, the procedure for setting up WPA, WPA2 and 802.1x security settings is different from that of other operating systems (other security types are not affected).

The procedures for setting up WPA, WPA2 or 802.1x in Vista are the same. However, the procedure differs depending on whether you use PEAP (Protected Extensible Authentication Protocol) or TLS (Transport Layer Security) encryption. Consult your network administrator if you are unsure which type of encryption to use.

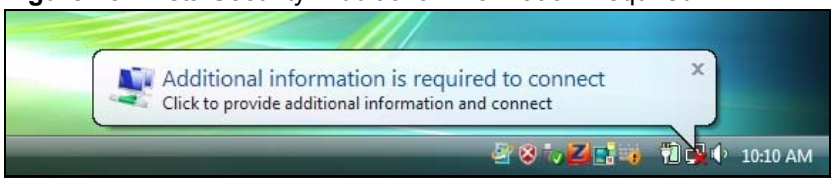
See Section 4.8.1 on page 70 to use PEAP, or see Section 4.8.2 on page 70 to use TLS.

4.8.1 Using PEAP in Vista

Take the following steps to set up WPA, WPA2 or 802.1x security using PEAP in Windows Vista.

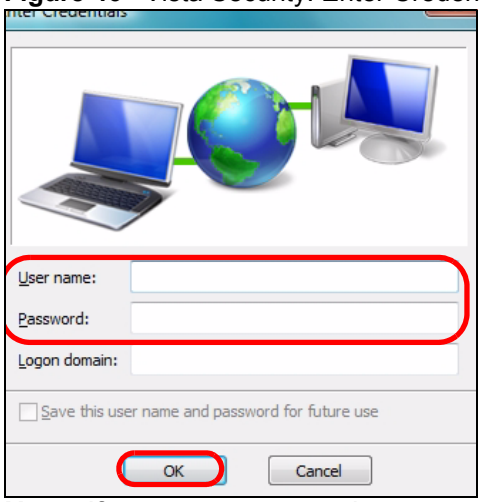
1. Either select the AP to which you want to connect in the **Site Survey** screen (see Section 4.3 on page 54), or configure a profile in the normal way (see Section 4.4 on page 60).
2. In the **WPA**, **WPA2** or **802.1x** security screen (see Section 3.2.3.2 on page 40 and Section 3.2.3.3 on page 40), select **PEAP** as the **EAP Type**. Note that the **Login Name**, **Logon Domain**, and **Password** fields are not available in the Vista utility, you will be able to enter them in the Vista Security screen below.
3. Click **Next**.
4. In the Summary screen that appears, click **Save**.
5. A message similar to the following appears in the bottom-right of your screen. Click the message.

Figure 45 Vista Security: Additional Information Required



6. The **Enter Credentials** screen displays. Enter your **User name** and **Password** for the network to which you want to connect.

Figure 46 Vista Security: Enter Credentials



Note: If you are not sure what to enter, contact your network administrator.

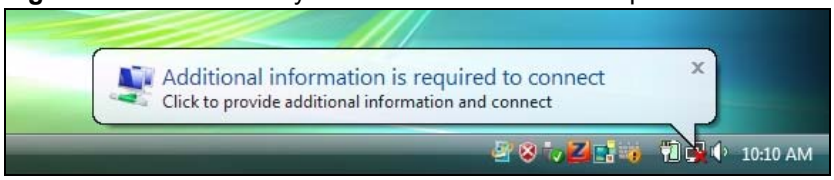
7. Click **OK**. The **Enter Credentials** screen disappears and the AG-220 tries to connect to the network. The ZyXEL utility's **Link Info** screen displays, showing the connection status (see Section 4.2 on page 52). If the **Link Info** screen displays an active connection, you have successfully completed the procedure.

4.8.2 Using TLS in Vista

Take the following steps to set up WPA, WPA2 or 802.1x security using TLS in Windows Vista.

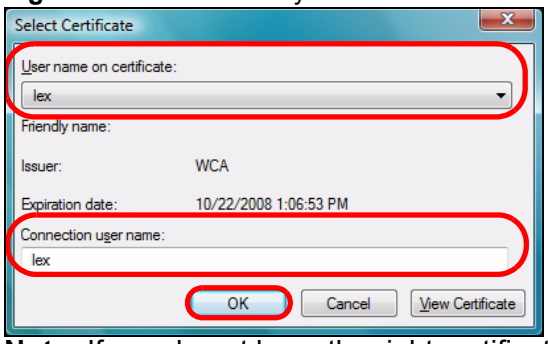
1 Either select the AP to which you want to connect in the **Site Survey** screen (see Section 4.3 on page 54), or configure a profile (see Section 4.4 on page 60) in the normal way.
2 In the **WPA**, **WPA2** or **802.1x** security screen, select **TLS** as the **EAP Type**. Note that the **Login Name** and **Certificate** fields are not available. You will be able to configure these soon in the Vista Security screens below.
3 Click **Next**.
4 In the Summary screen, click **Save**.
5 A message similar to the following appears in the bottom-right of your screen. Click the message.

Figure 47 Vista Security: Additional Information Required



6 The **Select Certificate** screen displays. Select the certificate you want to use in order to authenticate with the server, and enter your username.

Figure 48 Vista Security: Select Certificate



Note: If you do not have the right certificate, or are not sure which certificate you should use, contact your network administrator.

7 Click **OK**. The **Select Certificate** screen disappears and the AG-220 tries to connect to the network. The ZyXEL utility's **Link Info** screen displays, showing the connection status (see Section 4.2 on page 52). If the **Link Info** screen displays an active connection, you have successfully completed the procedure.

CHAPTER 5
Access Point Mode Configuration

This chapter shows you how to configure your AG-220 in access point mode.

Note: Access Point Mode is not available in Windows Vista.

5.1 Access Point Mode Introduction

To set your AG-220 to access point (AP) mode, select **AP Mode** in any utility screen (refer to Section 1.2.3 on page 25).

Access point mode allows you to set up your wireless networks without using a dedicated AP.

5.1.1 ZyXEL Utility Screen Summary

This section describes the ZyXEL utility screens when the AG-220 is in AP mode.

Figure 49 ZyXEL Utility Menu Summary: AP Mode

The following table describes the menus.

Table 17 ZyXEL Utility Menu Summary: AP Mode

TAB	DESCRIPTION
AP Mode	
Link Info	Use this screen to see your current connection status, configuration and data rate statistics.
Configuration	Use this screen to configure wireless LAN settings.
Advanced	Use this screen to change the wireless network mode.
MAC Filter	Use this screen to configure which computer(s) you want access to the wireless LAN through the AG-220.

5.1.2 Additional Setup Requirements

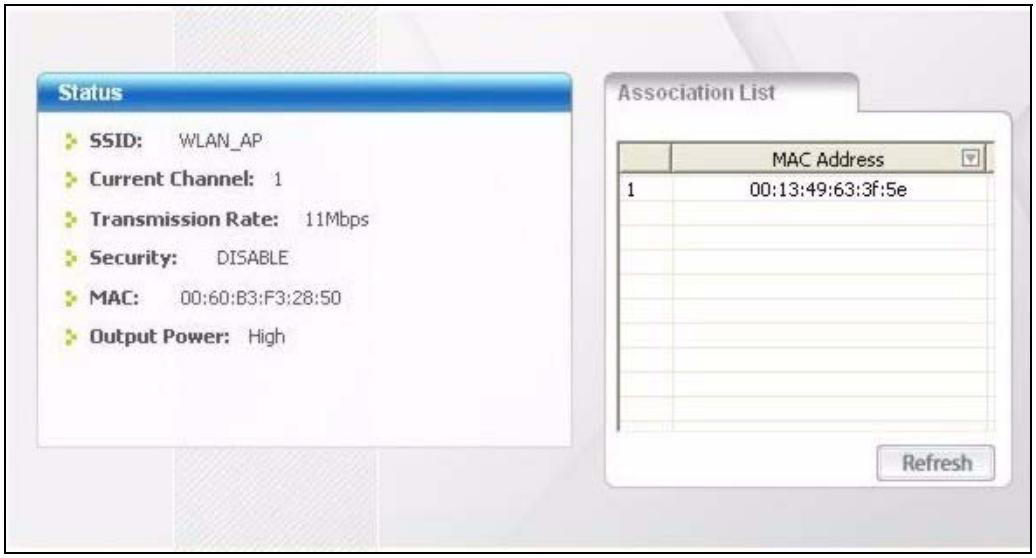
To bridge your wired and wireless network using the AG-220, the following requirements must be met:

1. The AG-220 must be installed on a computer connected to the wired network.
2. Either bridge the two interfaces (wireless and wired) on the computer (using the **Configuration** screen of the ZyXEL utility in Windows XP) or configure network sharing (refer to Appendix B on page 89 for an example).
3. Set the wireless station's IP address to be dynamic if you want the wireless stations to access the wired network or the Internet through the AG-220. Refer to Appendix E on page 121 for how to configure your computer's IP address.

5.2 The Link Info Screen

Select the **AP Mode** check box and wait for about five seconds to display the screen as shown.

Figure 50 Access Point Mode: Link Info



The following table describes the labels in this screen.

Table 18 Access Point Mode: Link Info

LABEL	DESCRIPTION
Status	
SSID	This field displays the name that identifies your AG-220 in the wireless LAN network.
Current Channel	This field displays the radio channel the AG-220 is currently using.
Transmission Rate	This field displays the current transmission rate of the AG-220 in megabits per second (Mbps).

Table 18 Access Point Mode: Link Info (continued)

LABEL	DESCRIPTION
Security	This field shows whether data encryption is activated (**WEP**) or inactive (**DISABLE**).
MAC	This field displays the MAC address of the AG-220.
Output Power	This field shows the strength of the AG-220's antenna gain or transmission power.
Association List	This table lists up to 16 wireless clients that are currently connected to the AG-220.
	denotes a wireless client without WEP security. denotes a wireless client with WEP security enabled.
MAC Address	This field displays the MAC addresses of a wireless client that is currently connected to the AG-220.
Refresh	Click **Refresh** to update this screen.

5.3 The Configuration Screen

Click **Configuration** in the ZyXEL utility screen to display the screen as shown.

Figure 51 Access Point Mode: Configuration

The following table describes the labels in this screen.

Table 19 Access Point Mode: Configuration

LABEL	DESCRIPTION
Wireless Settings	
SSID	The SSID identifies the wireless network to which a wireless station is associated. Wireless stations associating to the access point (the AG-220) must have the same SSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN.
Hide SSID	Select this check box to hide the SSID so an intruder cannot obtain the SSID through scanning using a site survey tool.
Channel	Set the operating frequency/channel depending on your geographical region.
Output Power	Set this field if you need to conserve power consumption (especially for notebook computers). This control changes the strength of the AG-220's antenna gain or transmission power. Antenna gain, measured in dBm (decibel relative units compared to milliwatts), is the increase in coverage. Higher antenna gain improves the range of the signal for better communications. Select **High** to set the AG-220's antenna to transmit at 17-dBm. Select **Medium-High** to set the AG-220's antenna to transmit at 15-dBm. Select **Medium-Low** to set the AG-220's antenna to transmit at 13-dBm. Select **Low** to set the AG-220's antenna to transmit at 11-dBm. This allows for the least power consumption.
Bridge	Select the check box and an Ethernet adapter (network interface card (NIC)) on your computer from the drop-down list box. This allows you to connect your wireless network to the specified wired network.
Security Settings	
WEP	Select **64 Bits**, **128 Bits** or **256 Bits** to activate WEP encryption and then fill in the related fields. Select **Disable** to deactivate the WEP encryption.
Authentication Type	Select an authentication method. Choices are **Auto**, **Shared Key** and **Open System**.- Refer to Section 3.2.3.1.2 on page 39 for more information.
Pass Phrase	When you select the radio button, enter a passphrase of up to 63 case-sensitive printable characters. As you enter the passphrase, the AG-220 automatically generates four different WEP key and displays it in the key field below. Refer to Section 3.2.3.1 on page 39 for more information. At the time of writing, you cannot use passphrase to generate 256-bit WEP keys.
Transmit Key	Select a default WEP key to use for data encryption. The key displays in the field below.

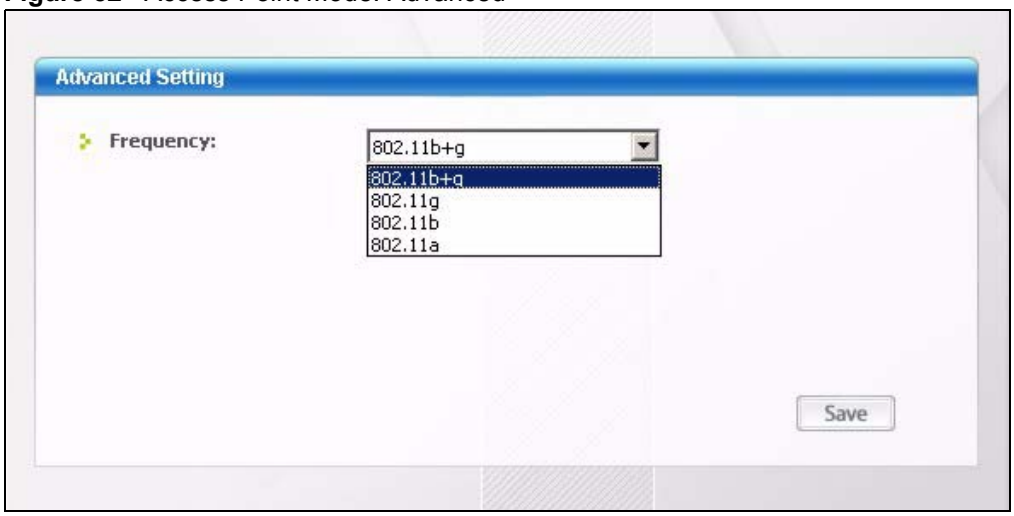
Table 19 Access Point Mode: Configuration (continued)

LABEL	DESCRIPTION
Key x (where x is a number between 1 and 4)	Select this option if you want to manually enter the WEP keys. Enter the WEP key in the field provided. If you select **64 Bits** in the **WEP** field. Enter either 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 11AA22BB33) for HEX key type or Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for ASCII key type. If you select **128 Bits** in the **WEP** field, Enter either 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 00112233445566778899AABBCC) for HEX key type or Enter 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey12345678) for ASCII key type. If you select **256 Bits** in the **WEP** field, Enter either 58 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 000011112222333344445555666777788889999AAAABBBBCCCC000011) for HEX key type or Enter 29 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey11112222333344445555678) for ASCII key type. **Note:** The values for the WEP keys must be set up exactly the same on all wireless devices in the same wireless LAN. ASCII WEP keys are case sensitive.
Save	Click **Save** to save the changes.
Cancel	Click **Cancel** to discard the changes.

5.4 The Advanced Screen

To set the network mode of the AG-220, click the **Advanced** tab.

Figure 52 Access Point Mode: Advanced



The following table describes the labels in this screen.

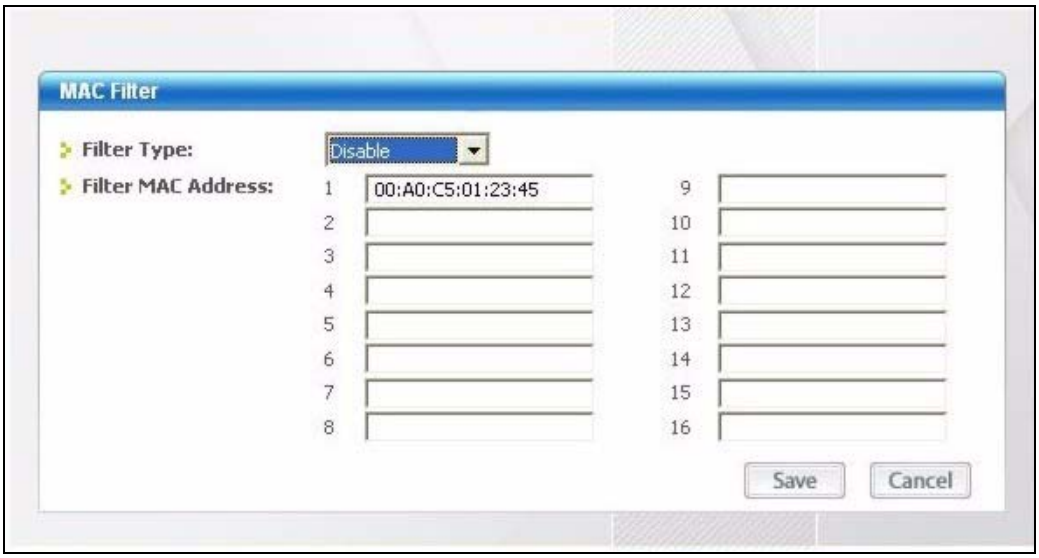
Table 20 Access Point Mode: Advanced

LABEL	DESCRIPTION
Advanced Setting	
Frequency	Choose a network mode. Select **802.11b+g** to have your AG-220 connect to other wireless devices in either IEEE 802.11 b or 802.11g modes. Alternatively, select **802.11g**, **802.11b** or **802.11a** to have your AG-220 connect to other wireless devices in b, g or a mode only.
Save	Click **Save** to save the changes to the AG-220. If you are connected to a wireless network when changing network modes, the AG-220 will disconnect and then attempt to reestablish the connection using the new setting.

5.5 The MAC Filter Screen

The **MAC Filter** screen allows you to configure the AG-220 to give exclusive access to devices (**Accept**) or exclude devices from connecting to the AG-220 (**Reject**). The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the device(s) to configure this screen. See Section 3.2.2 on page 38 for more information.

Figure 53 Access Point Mode: MAC Filter



The following table describes the labels in this screen.

Table 21 Access Point Mode: MAC Filter

LABEL	DESCRIPTION
Filter Type	Define the filter action for the list of MAC addresses in the MAC address filter table. Select **Disable** to deactivate the MAC filter feature. Select **Reject** to block access to the AG-220, MAC addresses not listed will be allowed to access the AG-220. Select **Accept** to permit access to the AG-220, MAC addresses not listed will be denied access to the AG-220.
Filter MAC Address 1-16	Specify the MAC address(es) of the wireless station(s) that is allowed or denied association to the AG-220. Enter six pairs of hexadecimal digits (separated by colons) in the range of "A-F", "a-f" and "0-9" (for example, 00:A0:C5:00:00:02). If you enter an invalid MAC address, once you click **Save** to save the values, a warning screen will be displayed.
Save	Click **Save** to save the changes to the AG-220.
Cancel	Click **Cancel** to discard the changes.

CHAPTER 6
Maintenance

This chapter describes how to uninstall or upgrade the ZyXEL utility.

6.1 The About Screen

The **About** screen displays driver and utility version numbers of the AG-220. To display the screen as shown below, click the about ( ) button.

Figure 54 About

The following table describes the read-only fields in this screen.

Table 22 About

LABEL	DESCRIPTION
Driver Version	This field displays the version number of the AG-220 driver.
Utility Version	This field displays the version number of the ZyXEL utility.

6.2 Uninstalling the ZyXEL Utility

6.2.1 Windows XP

Follow the steps below to remove (or uninstall) the ZyXEL utility from your Windows XP computer.

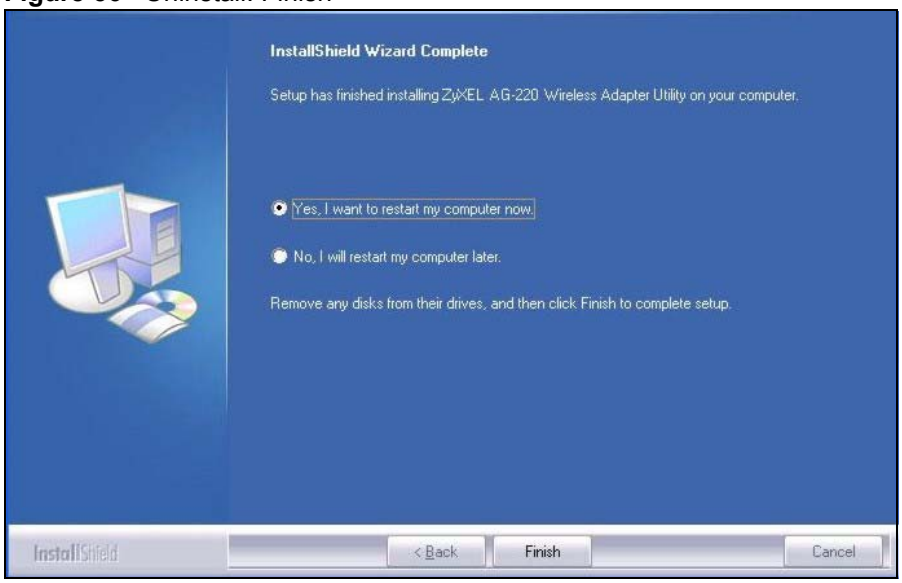
1 Click **Start**, **(All) Programs**, **ZyXEL AG-220 Wireless USB Adapter Utility**, **Uninstall ZyXEL AG-220 Wireless USB Adapter Utility**.

2 When prompted, click **OK** or **Yes** to remove the driver and the utility software.

Figure 55 Uninstall: Confirm

3 Click **Finish** to complete uninstalling the software and restart the computer when prompted.

Figure 56 Uninstall: Finish



6.2.2 Windows Vista

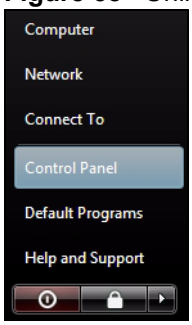
Follow the steps below to remove (or uninstall) the ZyXEL utility from your Windows Vista computer.

1 Click the Start icon on the Windows Vista taskbar.

Figure 57 Uninstall: Start

2 In the menu that displays click **Control Panel**.

Figure 58 Uninstall: Control Panel

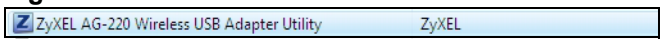


3 On the **Control Panel** screen click **Uninstall a program**.

Figure 59 Uninstall: Control Panel

4 On the Uninstall Program screen double click **ZyXEL AG-220 Wireless USB Adapter Utility**. You may need to scroll down to find this if you have many programs installed.

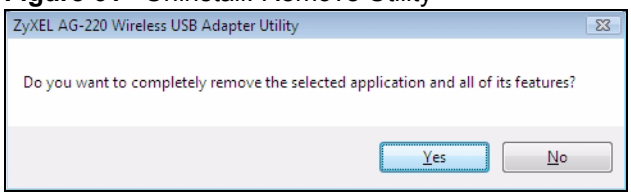
Figure 60 Uninstall: Control Panel



5 Windows Vista will ask for your permission to uninstall the program.

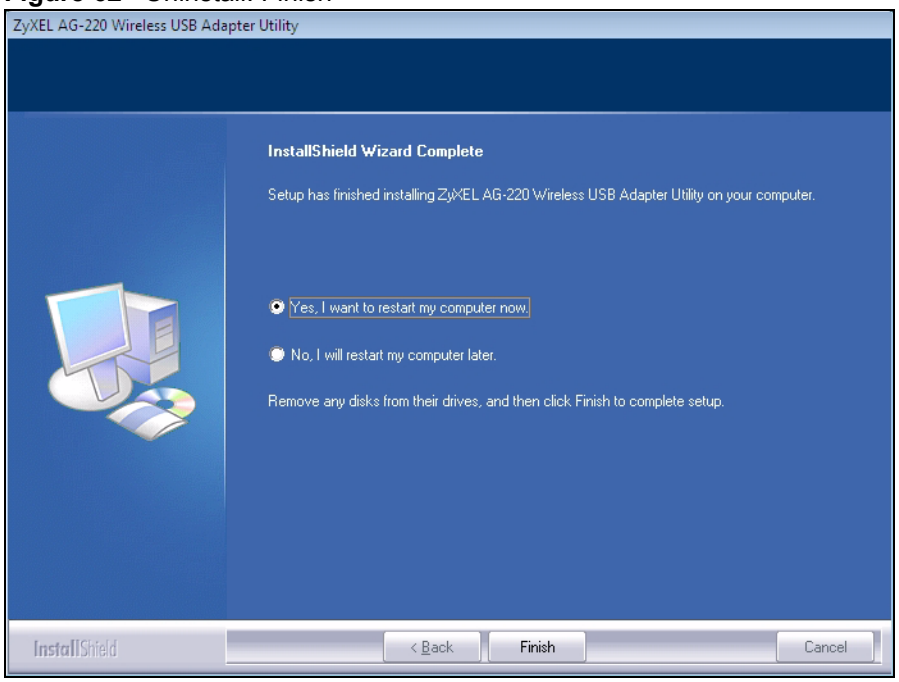
6 If you give Windows Vista your permission to uninstall the ZyXEL utility the following screen will display. Click **Yes** to uninstall the ZyXEL utility.

Figure 61 Uninstall: Remove Utility



7 After the program uninstalls the following screen will display. Select whether to restart your computer now or later and click **Finish**.

Figure 62 Uninstall: Finish



6.3 Upgrading the ZyXEL Utility

Note: Before you uninstall the ZyXEL utility, take note of your current wireless configurations.

To perform the upgrade, follow the steps below.

1. Download the latest version of the utility from the ZyXEL web site and save the file on your computer.
2. Follow the steps in Section 6.2 on page 81 to remove the current ZyXEL utility from your computer.
3. Restart your computer when prompted.
4. Disconnect the AG-220 from your computer.
5. Double-click on the setup program for the new utility to start the ZyXEL utility installation.
6. Insert the AG-220 and check the version numbers in the **About** screen to make sure the new utility is installed properly.

CHAPTER 7
Troubleshooting

This chapter covers potential problems and the possible remedies. After each problem description, some instructions are provided to help you to diagnose and to solve the problem.

7.1 Problems Starting the ZyXEL Utility

Table 23 Troubleshooting Starting ZyXEL Utility

PROBLEM	CORRECTIVE ACTION
Cannot start the ZyXEL Wireless LAN utility	Make sure the AG-220 is properly inserted and the LED is on. Refer to the Quick Start Guide for the LED descriptions. Use the **Device Manager** to check for possible hardware conflicts. Click **Start**, **Settings**, **Control Panel**, **System**, **Hardware** and **Device Manager**. Verify the status of the AG-220 under **Network Adapter**. (Steps may vary depending on the version of Windows). Install the AG-220 in another computer. If the error persists, you may have a hardware problem. In this case, you should contact your local vendor.
The ZyXEL utility icon does not display.	If you have installed the Funk Odyssey Client software on the computer, uninstall (remove) both the Funk Odyssey Client software and ZyXEL utility, and then install the ZyXEL utility again after restarting the computer.

7.2 Problem Connecting to an Access Point

Table 24 Troubleshooting Access Point Connection Problem

PROBLEM	CORRECTIVE ACTION
When using the Windows XP configuration tool, the AG-220 cannot scan for or connect to any access points.	The AG-220 might still be operating in access point mode. This results when you set the AG-220 to operate in access point mode using the ZyXEL utility, close the ZyXEL utility and then use the Windows XP configuration tool. Before you use the Windows XP configuration tool, make sure you set the AG-220 to operate in station mode before you close and exit the ZyXEL utility.

7.3 Problem with the Link Quality

Table 25 Troubleshooting Link Quality

PROBLEM	CORRECTIVE ACTION
The link quality and/or signal strength is poor all the time.	Search and connect to another AP with a better link quality using the **Site Survey** screen. Move your computer closer to the AP or the peer computer(s) within the transmission range. There may be too much radio interference (for example microwave or another AP using the same channel) around your wireless network. Lower the output power of each AP. Make sure there are not too many wireless stations connected to a wireless network.

7.4 Problems Communicating With Other Computers

Table 26 Troubleshooting Communication Problems

PROBLEM	CORRECTIVE ACTION
In wireless station mode, the computer with the AG-220 installed cannot communicate with the other computer(s).	In Infrastructure Mode • Make sure that the AP and the associated computers are turned on and working properly. • Make sure the AG-220 computer and the associated AP use the same SSID. • Change the AP and the associated wireless clients to use another radio channel if interference is high. • Make sure that the computer and the AP share the same security option and key. Verify the settings in the **Profile Security Setting** screen. • If you are using WPA(2) or WPA(2)-PSK security, try changing your encryption type from TKIP to AES or vice versa. In Ad-Hoc (IBSS) Mode • Verify that the peer computer(s) is turned on. • Make sure the AG-220 computer and the peer computer(s) are using the same SSID and channel. • Make sure that the computer and the peer computer(s) share the same security settings. • Change the wireless clients to use another radio channel if interference is high.
In access point mode, the wireless station(s) cannot associate to the AG-220.	Verify that the computer with the AG-220 installed is turned on. Make sure the wireless station(s) uses the same SSID as the AG-220. Make sure the wireless station(s) uses the same security settings. Verify that the wireless station(s) is not blocked in the **MAC Filter** screen.

APPENDIX A
Product Specifications

Table 27 Product Specifications

PHYSICAL AND ENVIRONMENTAL	
Product Name	ZyXEL AG-220 802.11a/g Wireless USB Adapter
Interface	USB 2.0 compatible
Standards	IEEE 802.11a IEEE 802.11b IEEE 802.11g
Network Architectures	Infrastructure Ad-Hoc
Operating Temperature	0 ~ 50 degrees Centigrade
Storage Temperature	-30 ~ 60 degrees Centigrade
Operating Humidity	20 ~ 95% (non-condensing)
Storage Humidity	20 ~ 95% (non-condensing)
Power	TX power consumption: < 380mA RX power consumption: < 200mA
Voltage	5V
Weight	25.8 g
Dimension	(W) 95 mm × (D) 30 mm × (H) 16 mm
RADIO SPECIFICATIONS	
Media Access Protocol	IEEE 802.11
Frequency	Industrial Scientific Medical Band 2.412 ~ 2.484 GHz (IEEE 802.11b/g) and 5.180 ~ 5.825GHz (IEEE 802.11a)

Table 27 Product Specifications (continued)

Operating Frequencies and Channels	IEEE 802.11b/g: 2.412 ~ 2.484 GHz FCC: 11 channels Taiwan: 11 channels CE: 13 channels IEEE 802.11a 5.180 ~ 5.825 GHz: 5.180 ~ 5.240 GHz FCC: 4 channels CE: 4 channels 5.260 ~ 5.320 GHz FCC: 4 channels Taiwan: 4 channels CE: 4 channels 5.500 ~ 5.700 GHz CE: 11 channels 5.745 ~ 5.825 GHz FCC: 5 channels Taiwan: 5 channels
Data Rate	11g: 54 Mbps with automatic fallback to 48, 36, 24, 18, 12, 9 and 6 Mbps 11b: 11 Mbps with automatic fallback to 11, 5.5, 2 and 1 Mbps
Modulation	IEEE 802.11a: 54, 48, 36, 24, 18, 12, 9, 6 Mbps (OFDM) IEEE 802.11b: 11, 5.5 Mbps (CCK), 2 Mbps (DQPSK), 1 Mbps (DBPSK) IEEE 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps (OFDM)
Average Output Power	IEEE 802.11a: 12dBm (+/- 2dBm) at 54Mbps, OFDM IEEE 802.11b: 17dBm (+/- 2dBm) at 11Mbps, CCK, QPSK, BPSPK IEEE 802.11g: 14dBm (+/- 2dBm) at 54Mbps, OFDM
RX Sensitivity	IEEE 802.11g (OFDM): 54 Mbps: < -70 dBm IEEE 802.11b (CCK): 11 Mbps: < -85 dBm
SOFTWARE SPECIFICATIONS	
Device Drivers	Microsoft Windows 98 Second Edition, Windows ME, Windows 2000, Windows XP, Windows XP 64-bit edition, Windows Vista
Security	64/128/256-bit WEP WPA/WPA-PSK/WPA2/WPA2-PSK IEEE 802.1x WPS (Windows Vista only)
Roaming	IEEE 802.11a/b/g compliant

APPENDIX B
Access Point Mode Setup Example

This example uses the network sharing feature in Windows 2000 to bridge the wired and wireless network when you set the AG-220 in access point (AP) mode.

Refer to Chapter 5 on page 73 for setup methods and requirements.

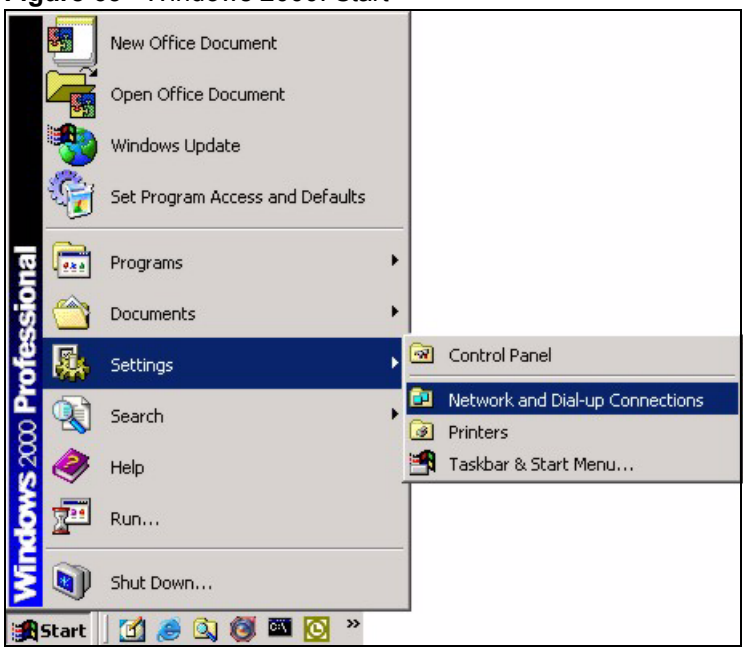
Steps may vary depending on your Windows version. You may need to install additional software in Windows 98 Second Edition and Windows ME.

Configuring the Computer on Which You Install the AG-220

1 Refer to Section 1.2.3 on page 25 to set the AG-220 to operate in AP mode.

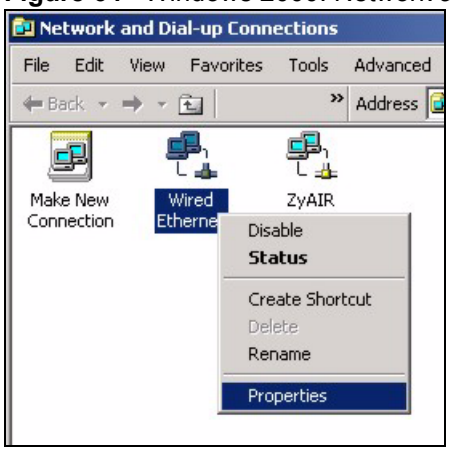
2 Click **Start**, **Settings**, **Network and Dial-up Connections** (or click **Start**, **Settings**, **Control Panel** and double-click **Network and Dial-up Connections**).

Figure 63 Windows 2000: Start



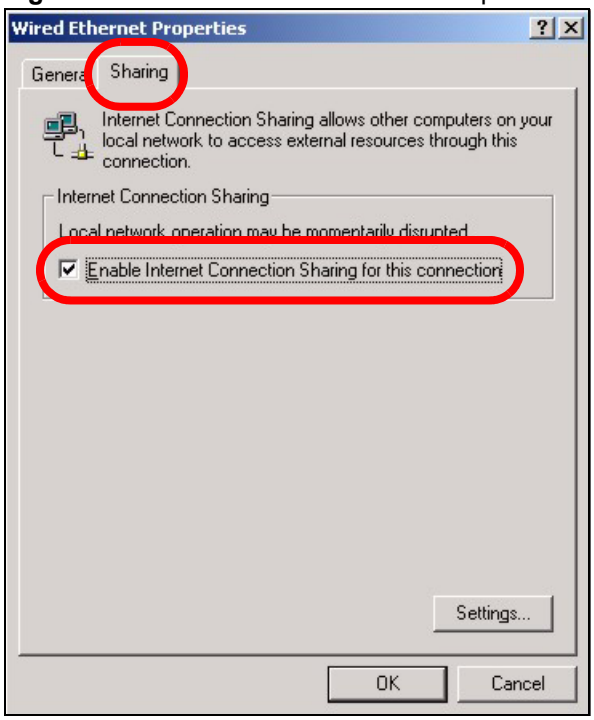
3 Right-click on the icon for your wired Ethernet adapter and click **Properties**.

Figure 64 Windows 2000: Network and Dial-up Connections



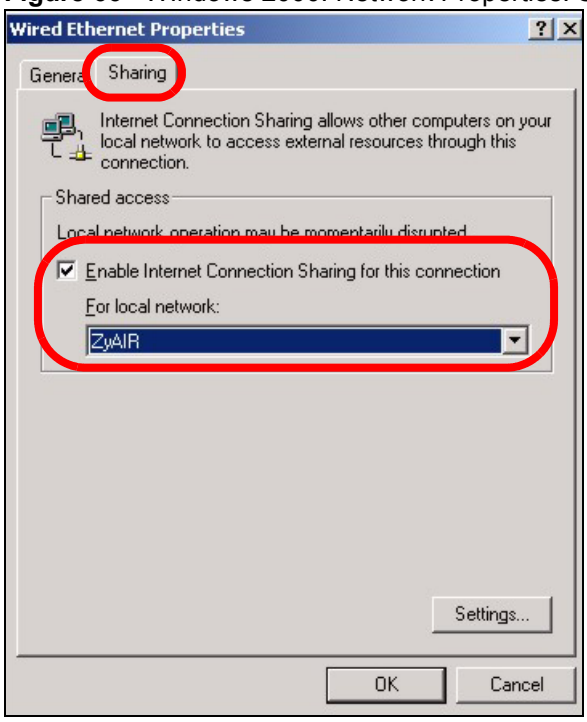
4 A **Properties** screen displays. Click the **Sharing** tab and select **Enable Internet Connection Sharing for this connection**. Click **OK**.

Figure 65 Windows 2000: Network Properties



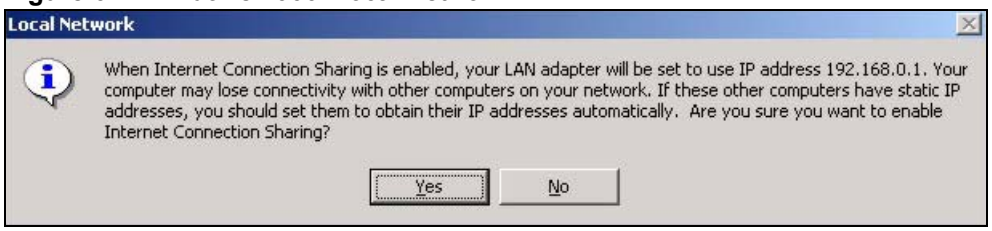
If there is more than one network adapter on the computer, select **Enable Internet Connection Sharing for this connection** and select the network adapter to which you want to share network access.

Figure 66 WIndows 2000: Network Properties: Select Network Adapter



5 A notice screen displays. Click **Yes**.

Figure 67 Windows 2000: Local Network



Configuring the Wireless Station Computer

Refer to Appendix E on page 121 for information on how to set up the IP address of a computer you want to connect wirelessly to the AG-220.

APPENDIX C
Windows Wireless Management

This appendix shows you how to manage your AG-220 using the Windows Vista and Windows XP wireless configuration tools.

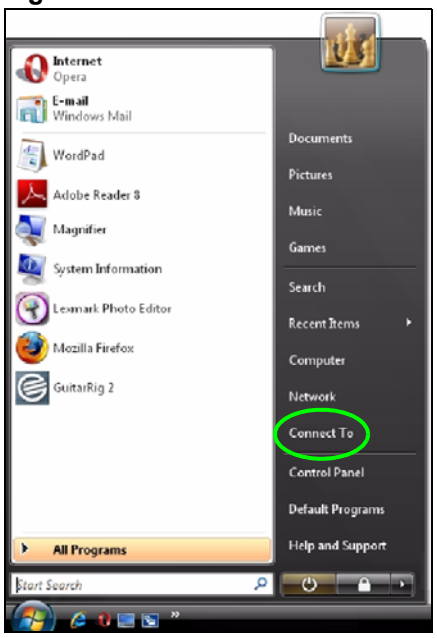
Windows Vista

Take the following steps to connect to a wireless network using the Windows Vista wireless configuration tool (WLAN AutoConfig).

Connecting to a Wireless Network

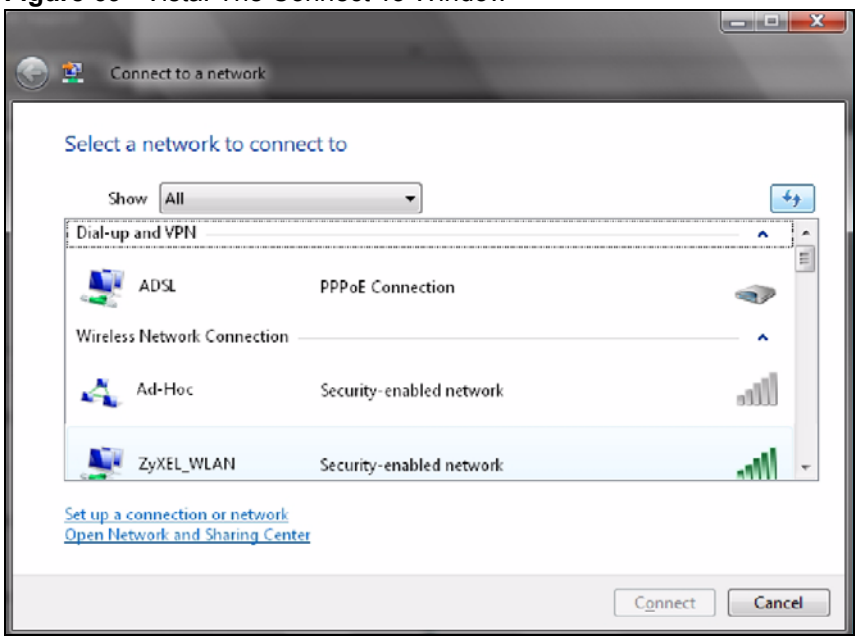
1 In the Windows Vista taskbar, click **Start** ( ) > **Connect To**.

Figure 68 Vista: Start Menu



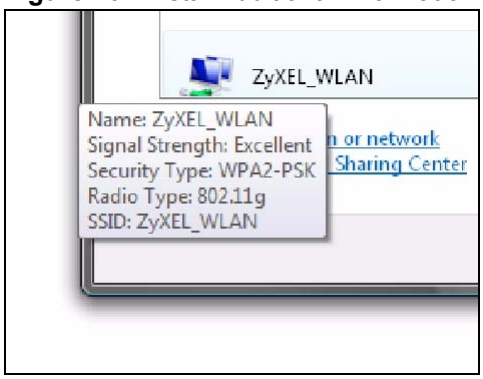
The **Connect To** window displays, showing all available networks.

Figure 69 Vista: The Connect To Window



The security status of each wireless network displays, as well as an indication of its signal strength. If you use the mouse pointer to hover over a network's entry, additional information about the network displays.

Figure 70 Vista: Additional Information

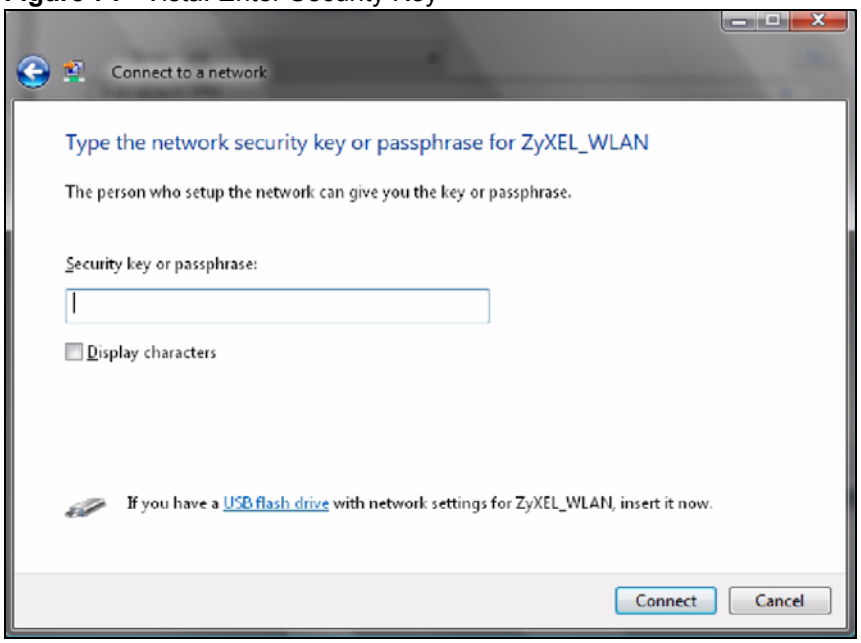


2 Double-click the network's name to join the network, or select a network and click **Connect**.

? If the network to which you want to connect does not display, see the section on setting up a connection manually on page <Link>96.

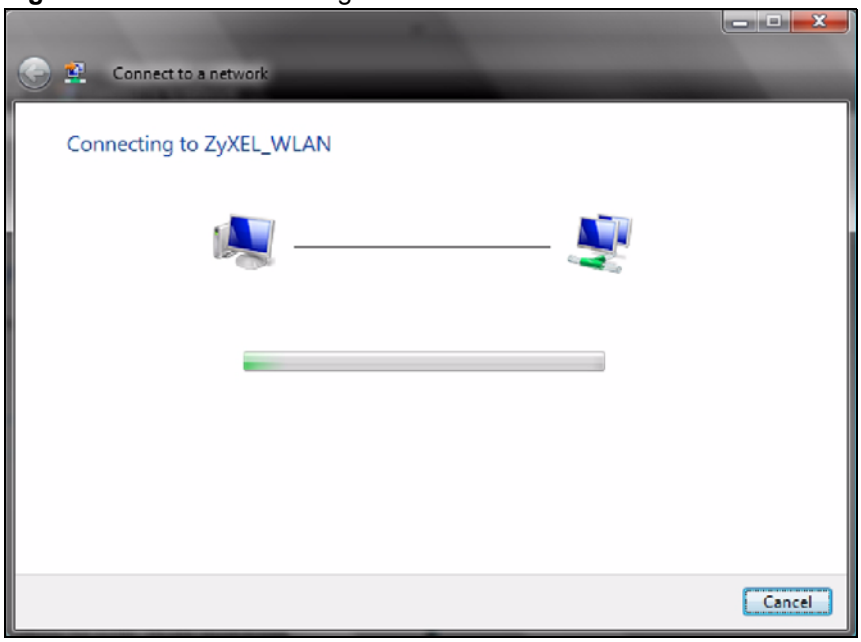
3 If security is enabled, you may be prompted to enter your security key.

Figure 71 Vista: Enter Security Key



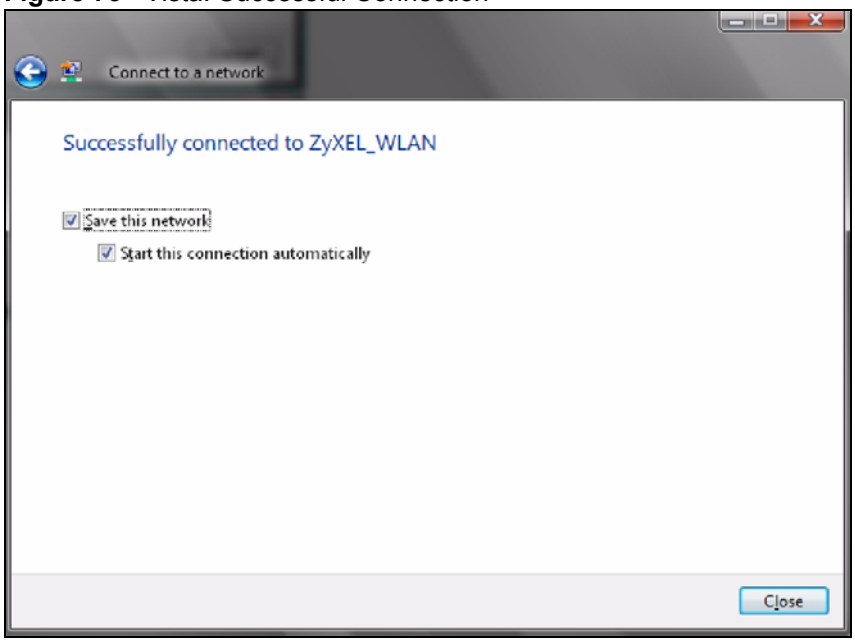
Your computer tries to connect to the wireless network.

Figure 72 Vista: Connecting



If your computer has connected to the wireless network successfully, the following screen displays.

Figure 73 Vista: Successful Connection



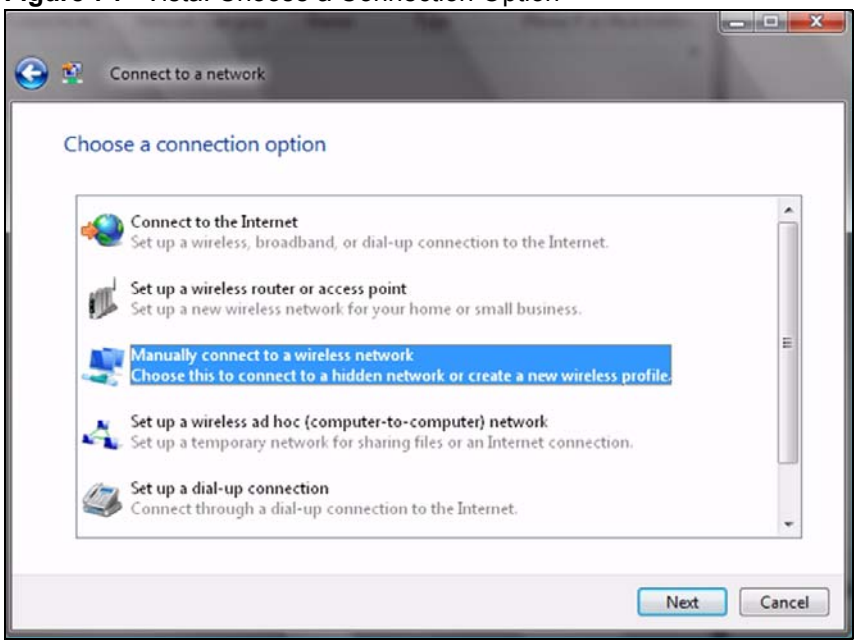
4. If you will use this network again, ensure that **Save this network** is selected. If you save the network, you do not have to configure its settings again.
5. Select **Start this connection automatically** if you want Windows to always try to use this network when you start up your computer. If you do not select this (but select **Save this network**) you can connect manually each time by clicking **Start** > **Connect to** and selecting the network's name from the list.

Connecting to a Network Manually

If the wireless network to which you want to connect does not appear in the **Connect to** window (if your network's SSID is hidden, for example), take the following steps to configure your network connection manually

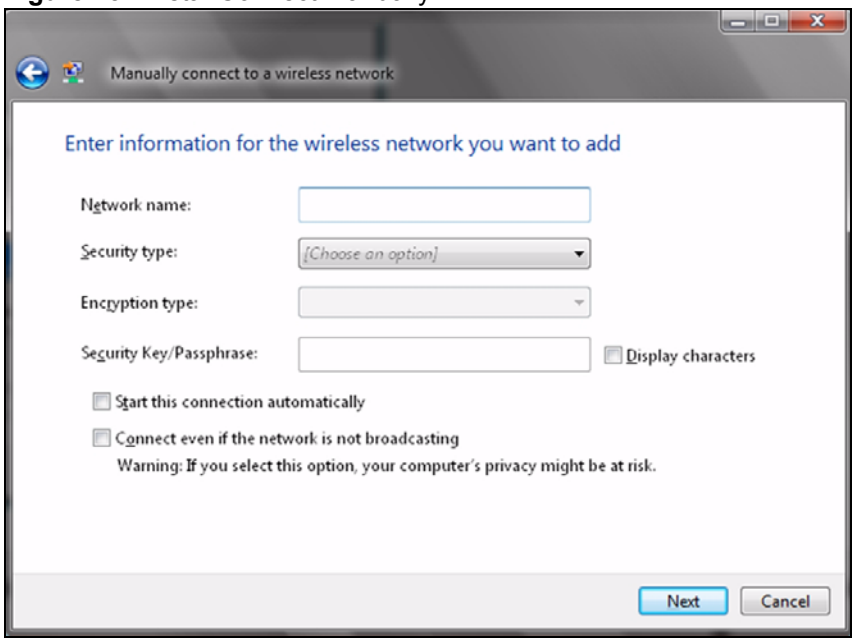
1. Click **Set up a connection or network** at the bottom of the **Connect to** screen. The following screen displays.

Figure 74 Vista: Choose a Connection Option



2 Click **Manually connect to a wireless network**. The following screen displays.

Figure 75 Vista: Connect Manually



The following table describes the labels in this screen.

Table 28 Vista: Connect Manually

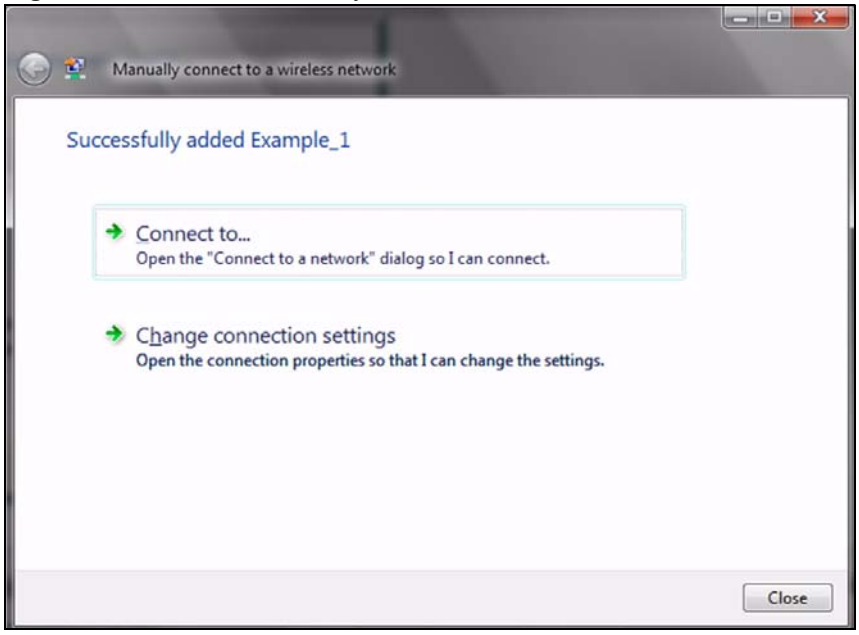
LABEL	DESCRIPTION
Network name	Enter your network's SSID (Service Set IDentifier).
Security type	Select the type of security used by the network to which you want to connect. The types of available security shown depend on your computer's wireless client. In this field, **WPA(2)-Personal** is the same as **WPA(2)-PSK**, and **WPA(2)-Enterprise** is the same as **WPA(2)**

Table 28 Vista: Connect Manually

LABEL	DESCRIPTION
Encryption type	Select the type of encryption used by the network. When you use **WEP** or **802.1x**, **WEP** displays. When you use a **WPA** mode (**WPA(2)-Personal** or **WPA(2)-Enterprise**) you can choose **AES** or **TKIP** (if supported by your computer's wireless client).
Security Key / Passphrase	If your network uses **WEP** or **WPA(2)-Personal** security, enter the key here.
Display Characters	Select this if you do not want the security key characters to be hidden.
Start this connection automatically	Select this box if you always want to try to connect to this network at startup. If you leave this box unchecked, you will need to connect manually each time.
Connect even if the network is not broadcasting	Select this box if you always want to try to connect to this network at startup, even if the network is not broadcasting its SSID. The warning in this field refers to the fact that if you do this, your computer sends out probe request packets, which contain the network's SSID and could be used by an attacker to access the network.
Next	Click this to save your settings and move on to the next page.
Cancel	Click this to stop setting up your network.

3 When you have finished filling in the fields, click **Next**. the following screen displays.

Figure 76 Vista: Successfully Added Network



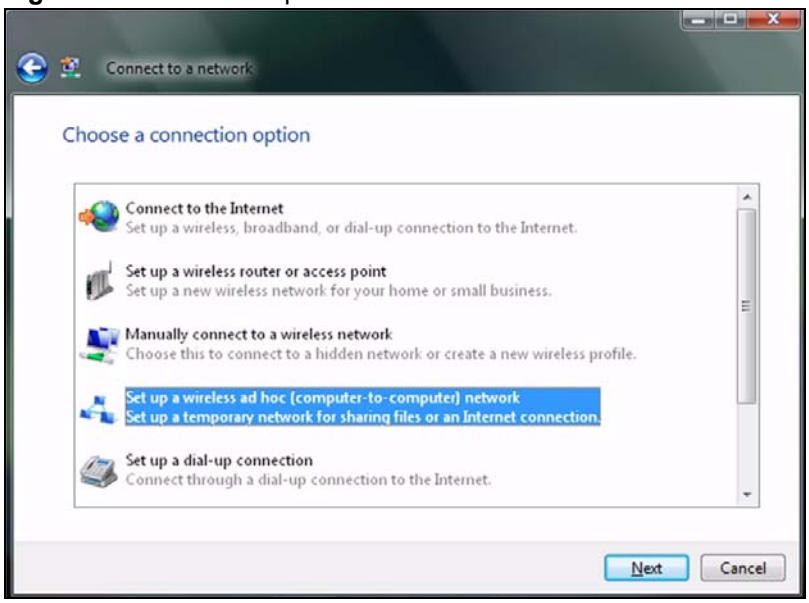
4 If you want to make any changes to the settings you just configured, click **Change connection settings**. Otherwise, click **Connect to...**. In the window that displays, double-click the new network's name to connect to the network.

Setting Up An Ad-Hoc Network

Take the following steps to set up a wireless connection between two computers in Windows Vista.

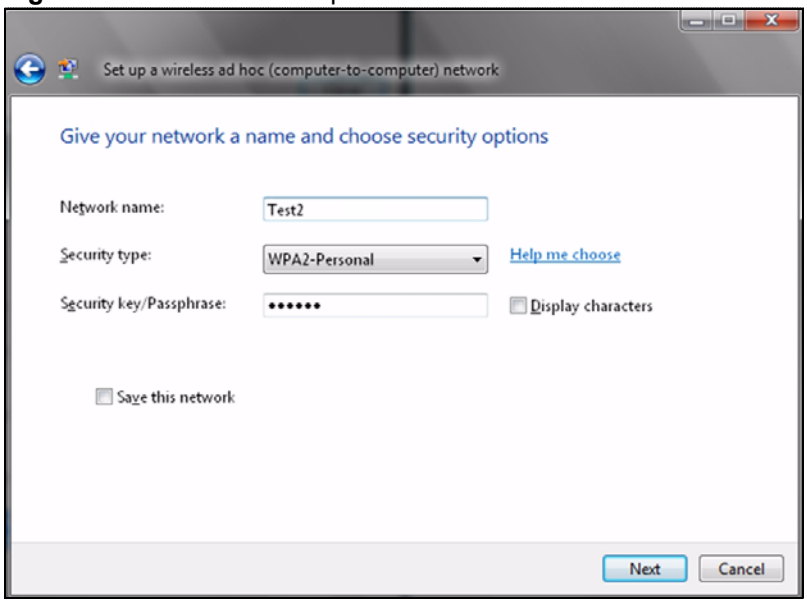
1 Click **Start** ( ) > **Connect To**. In the **Connect to** screen, click **Set up a connection or network**. The following screen displays.

Figure 77 Vista: Set Up An Ad-hoc Network



2 Select **Set up a wireless ad hoc (computer-to-computer) network** and click **Next**. The following screen displays.

Figure 78 Vista: Ad-hoc Options



3 Enter the **Network name** (SSID) you want to use for your network. Select a **Security type**. If you are not sure what kind of security you want to use, click the **Help me choose** link.

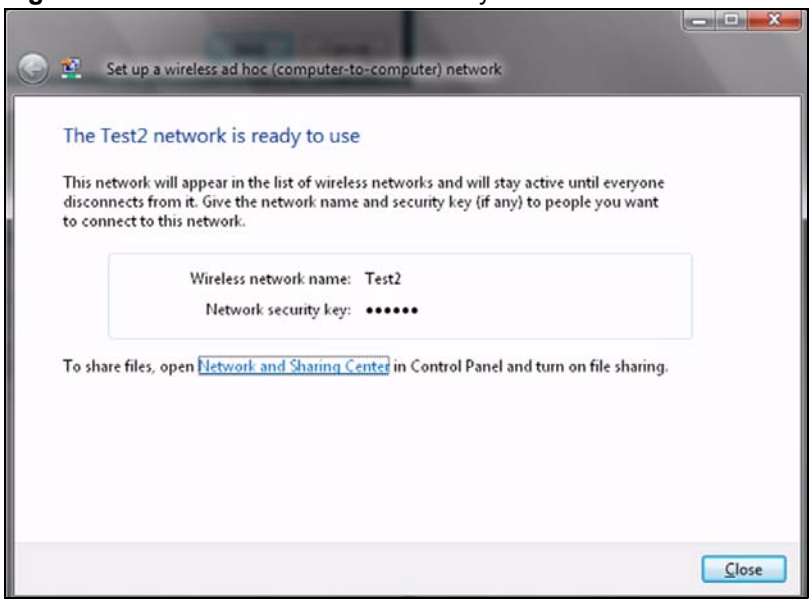
? Make sure all the wireless clients on your ad-hoc network can support the type of security you select.

4 Enter the **Security key/Passphrase**. Everybody on the network must enter this key in their computer's wireless client in order to access the network. If you want to see the characters you entered, select the **Display characters** box. Otherwise, leave it empty (dots display instead of the characters).

5 If you will use this ad-hoc network again, select the **Save this network** box. If you do this, the next time you click **Start** > **Connect to**, you can select the network from the list.

6 Click **Next**. The following screen displays.

Figure 79 Vista: Ad-hoc Network Ready



7 If you want to share files with other computers on the ad-hoc network, or let other computers use your Internet connection, click the **Network and Sharing Center** link. Otherwise, click **Close**.

Windows XP

Be sure you have the Windows XP service pack 2 installed on your computer. Otherwise, you should at least have the Windows XP service pack 1 already on your computer and download the support patch for WPA from the Microsoft web site.

Windows XP SP2 screen shots are shown unless otherwise specified. Click the help icon ( ) in most screens, move the cursor to the item that you want the information about and click to view the help.

Activating Wireless Zero Configuration

1 Click **Start**, **Control Panel** and double-click **Network Connections**.

2 Double-click on the icon for wireless network connection.

3 The status window displays as shown below. Click **Properties**.

Figure 80 Windows XP SP1: Wireless Network Connection Status

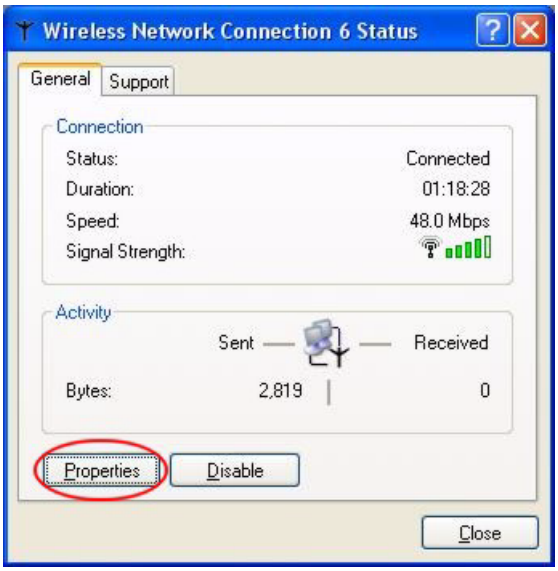
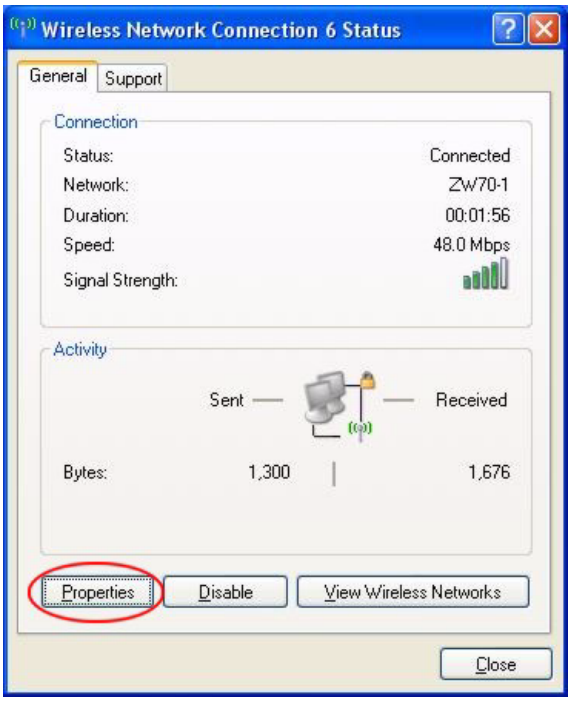


Figure 81 Windows XP SP2: Wireless Network Connection Status



4 The **Wireless Network Connection Properties** screen displays. Click the **Wireless Networks** tab.

Make sure the **Use Windows to configure my wireless network settings** check box is selected.

Figure 82 Windows XP SP1: Wireless Network Connection Properties

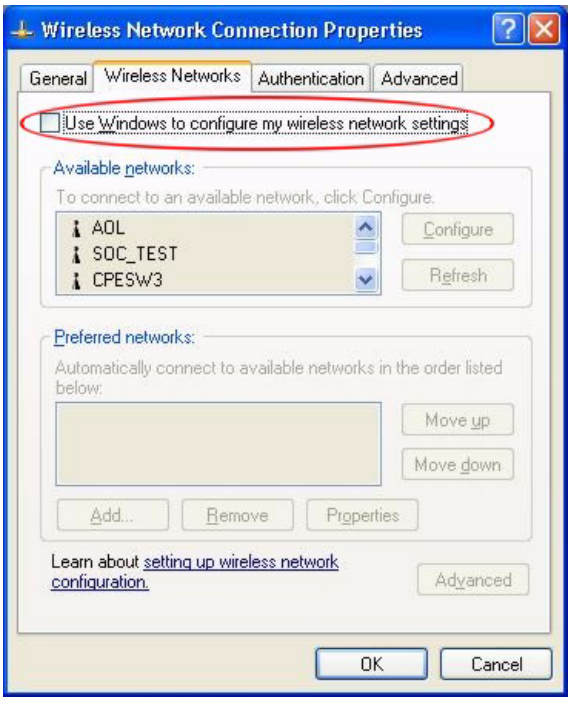
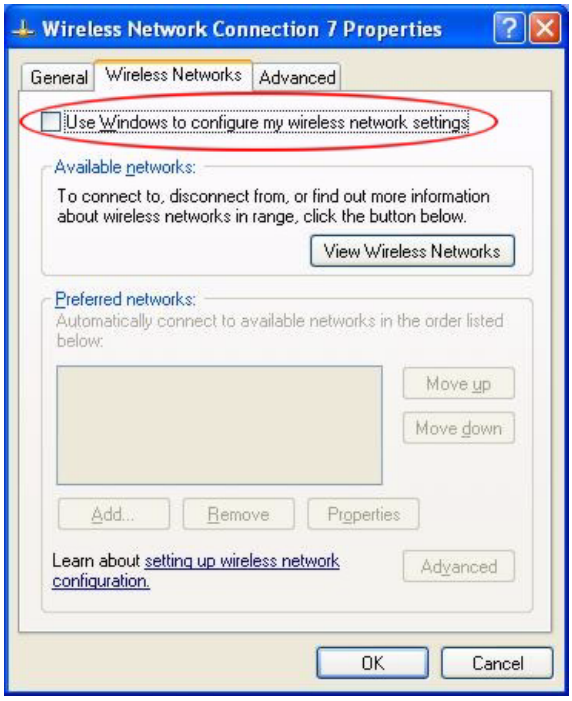
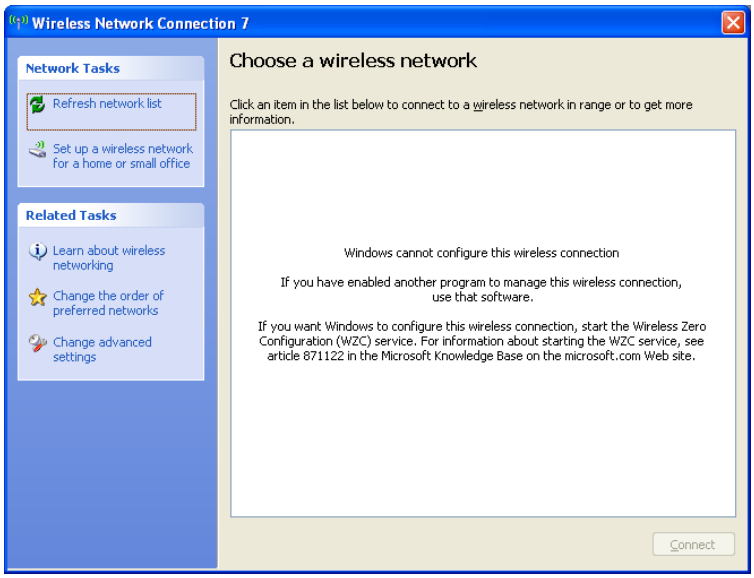


Figure 83 Windows XP SP2: Wireless Network Connection Properties



If you see the following screen, refer to article 871122 on the Microsoft web site for information on starting WZC.

Figure 84 Windows XP SP2: WZC Not Available



Connecting to a Wireless Network

1 Double-click the network icon for wireless connections in the system tray to open the Wireless Network Connection Status screen.

Figure 85 Windows XP SP2: System Tray Icon

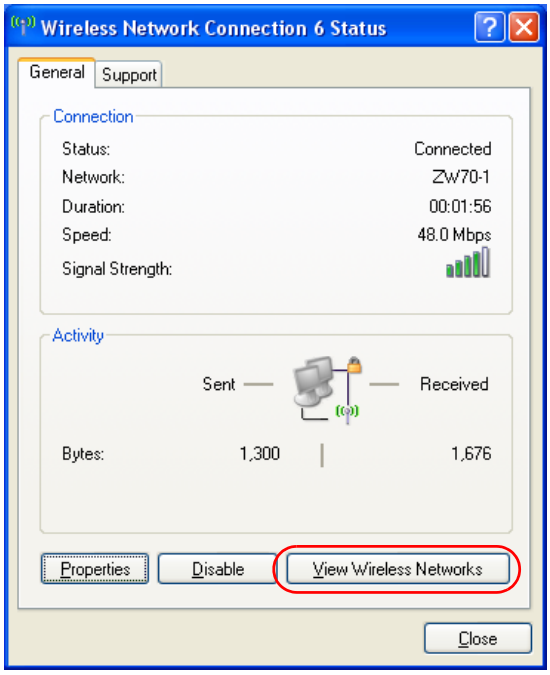
The type of the wireless network icon in Windows XP SP2 indicates the status of the AG-220. Refer to the following table for details.

Table 29 Windows XP SP2: System Tray Icon

ICON	DESCRIPTION
	The AG-220 is connected to a wireless network.
	The AG-220 is in the process of connecting to a wireless network.
	The connection to a wireless network is limited because the network did not assign a network address to the computer.
	The AG-220 is not connected to a wireless network.

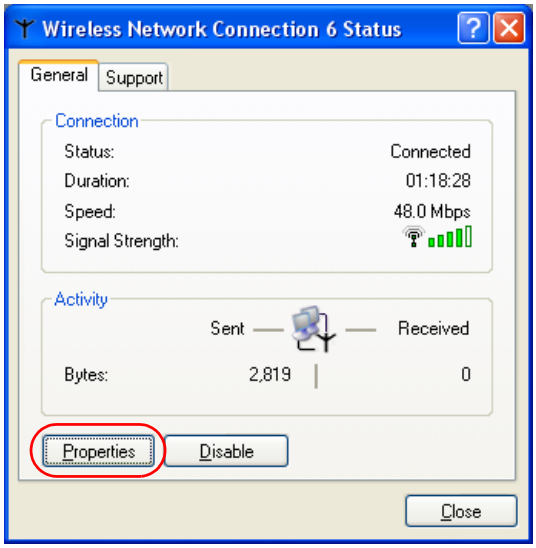
2 Windows XP SP2: In the **Wireless Network Connection Status** screen, click **View Wireless Networks** to open the **Wireless Network Connection** screen.

Figure 86 Windows XP SP2: Wireless Network Connection Status



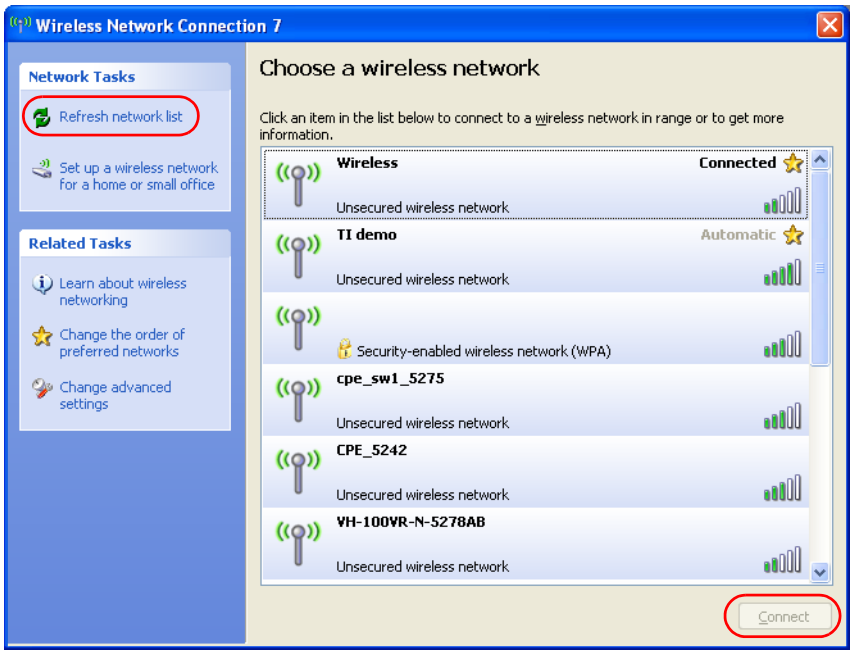
Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the **Wireless Network Connection Properties** screen.

Figure 87 Windows XP SP1: Wireless Network Connection Status



3 Windows XP SP2: Click **Refresh network list** to reload and search for available wireless devices within transmission range. Select a wireless network in the list and click **Connect** to join the selected wireless network.

Figure 88 Windows XP SP2: Wireless Network Connection



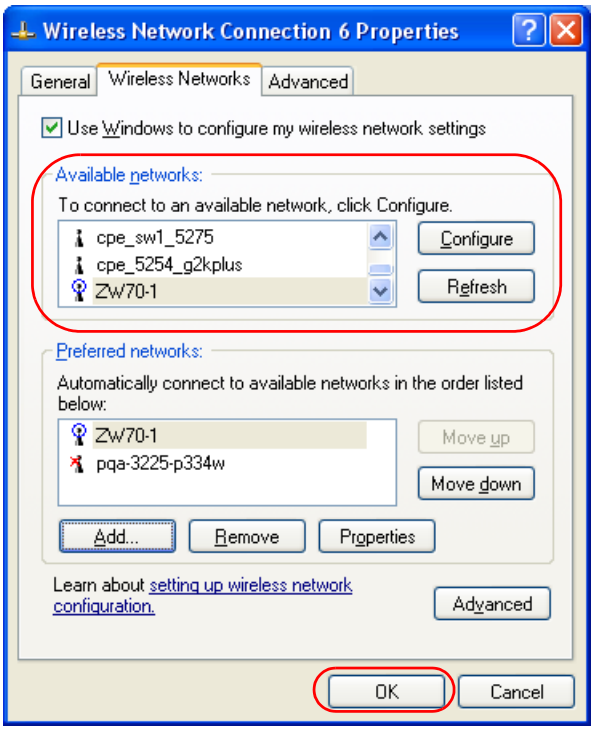
The following table describes the icons in the wireless network list.

Table 30 Windows XP SP2: Wireless Network Connection

ICON	DESCRIPTION
	This denotes that wireless security is activated for the wireless network.
	This denotes that this wireless network is your preferred network. Ordering your preferred networks is important because the AG-220 tries to associate to the preferred network first in the order that you specify. Refer to the section on ordering the preferred networks for detailed information.
	This denotes the signal strength of the wireless network. Move your cursor to the icon to see details on the signal strength.

Windows XP SP1: Click **Refresh** to reload and search for available wireless devices within transmission range. Select a wireless network in the **Available networks** list, click **Configure** and set the related fields to the same security settings as the associated AP to add the selected network into the **Preferred** networks table. Click **OK** to join the selected wireless network. Refer to the section on security settings (discussed later) for more information.

Figure 89 Windows XP SP1: Wireless Network Connection Properties



4 4.Windows XP SP2: If the wireless security is activated for the selected wireless network, the **Wireless Network Connection** screen displays. You must set the related fields in the **Wireless Network Connection** screen to the same security settings as the associated AP and click **Connect**. Refer to the section about security settings for more information. Otherwise click **Cancel** and connect to another wireless network without data encryption. If there is no security activated for the selected wireless network, a warning screen appears. Click **Connect Anyway** if wireless security is not your concern.

Figure 90 Windows XP SP2: Wireless Network Connection: WEP or WPA-PSK

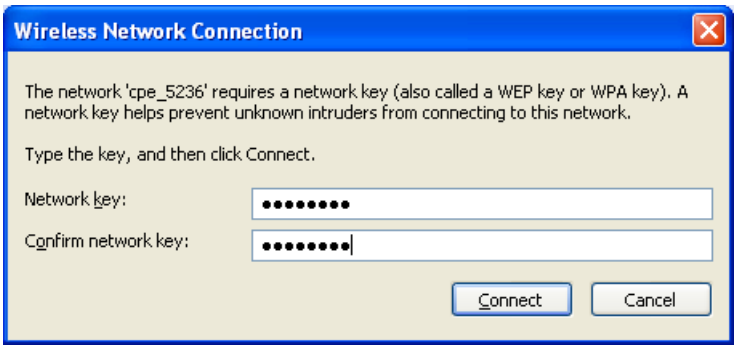


Figure 91 Windows XP SP2: Wireless Network Connection: No Security

5 Verify that you have successfully connected to the selected network and check the connection status in the wireless network list or the connection icon in the **Preferred networks** or **Available networks** list.

The following table describes the connection icons.

Table 31 Windows XP: Wireless Networks

ICON	DESCRIPTION
	This denotes the wireless network is an available wireless network.
	This denotes the AG-220 is associated to the wireless network.
	This denotes the wireless network is not available.

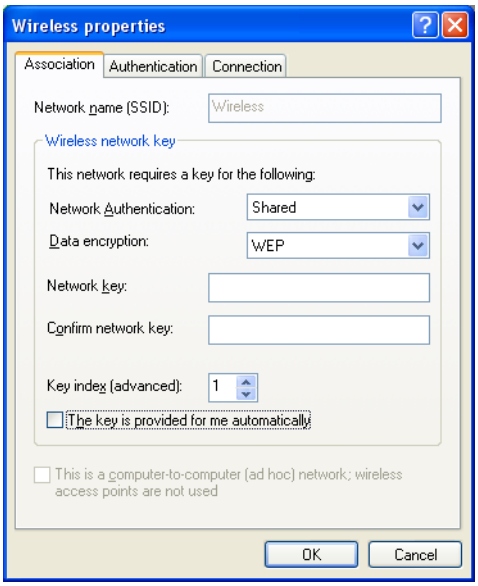
Security Settings

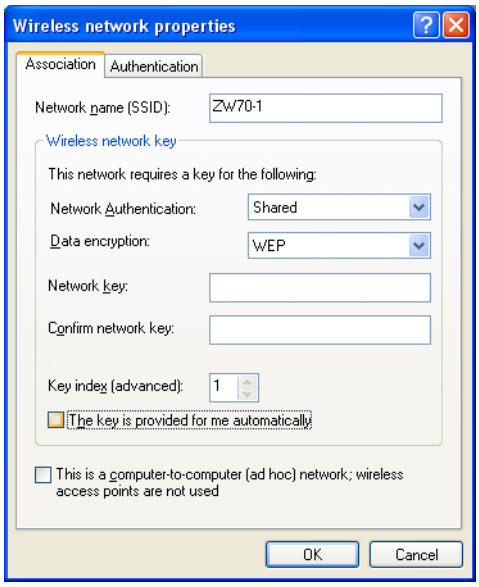
When you configure the AG-220 to connect to a secure network but the security settings are not yet enabled on the AG-220, you will see different screens according to the authentication and encryption methods used by the selected network.

Association

Select a network in the Preferred networks list and click Properties to view or configure security.

Figure 92 Windows XP: Wireless (network) properties: Association





The following table describes the labels in this screen.

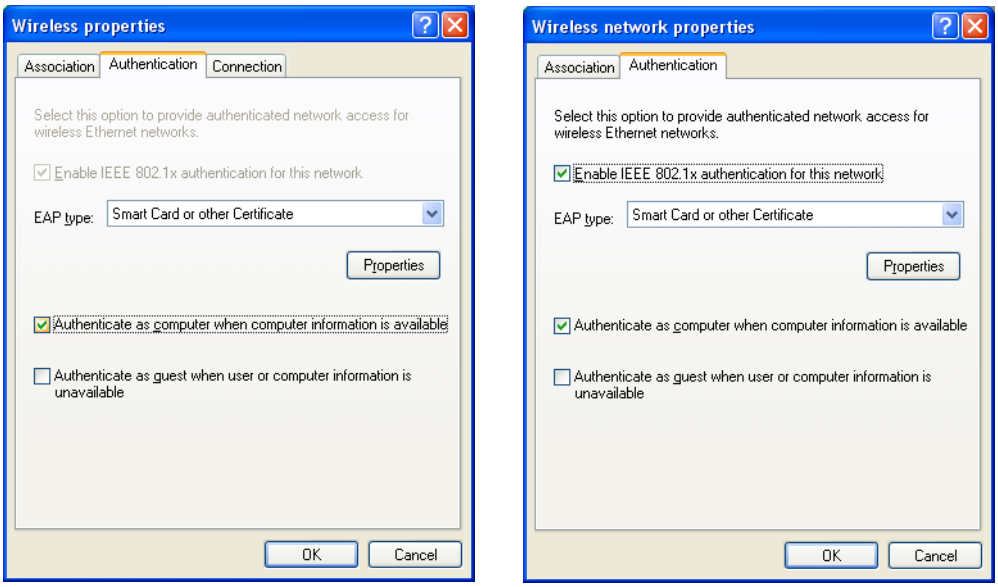
Table 32 Windows XP: Wireless (network) properties: Association

LABEL	DESCRIPTION
Network name (SSID)	This field displays the SSID (Service Set IDentifier) of each wireless network.
Network Authentication	This field automatically shows the authentication method (**Share**, **Open**, **WPA** or **WPA-PSK**) used by the selected network.
Data Encryption	This field automatically shows the encryption type (**TKIP**, **WEP** or **Disable**) used by the selected network.
Network Key	Enter the pre-shared key or WEP key. The values for the keys must be set up exactly the same on all wireless devices in the same wireless LAN.
Confirm network key	Enter the key again for confirmation.
Key index (advanced)	Select a default WEP key to use for data encryption. This field is available only when the network use **WEP** encryption method and the **The key is provided for me automatically** check box is not selected.
The key is provided for me automatically	If this check box is selected, the wireless AP assigns the AG-220 a key.
This is a computer-to-computer (ad hoc) network; wireless access points are not used	If this check box is selected, you are connecting to another computer directly.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Authentication

Click the **Authentication** tab in the **Wireless (network) properties** screen to display the screen shown next. The fields on this screen are grayed out when the network is in Ad-Hoc mode or data encryption is disabled.

Figure 93 Windows XP: Wireless (network) properties: Authentication



The following table describes the labels in this screen.

Table 33 Windows XP: Wireless (network) properties: Authentication

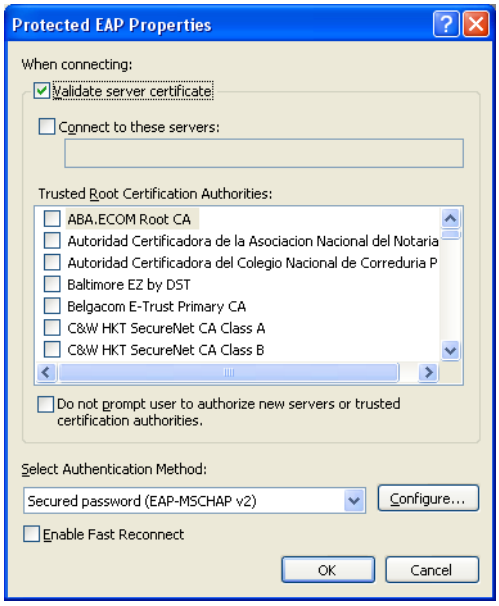
LABEL	DESCRIPTION
Enable IEEE 802.1x authentication for this network	This field displays whether the IEEE 802.1x authentication is active. If the network authentication is set to **Open** in the previous screen, you can choose to disable or enable this feature.
EAP Type	Select the type of EAP authentication. Options are **Protected EAP (PEAP)** and **Smart Card or other Certificate**.
Properties	Click this button to open the properties screen and configure certificates. The screen varies depending on what you select in the **EAP type** field.
Authenticate as computer when computer information is available	Select this check box to have the computer send its information to the network for authentication when a user is not logged on.
Authenticate as guest when user or computer information is unavailable	Select this check box to have the computer access to the network as a guest when a user is not logged on or computer information is not available.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Authentication Properties

Select an EAP authentication type in the **Wireless (network) properties: Authentication** screen and click the **Properties** button to display the following screen.

Protected EAP Properties

Figure 94 Windows XP: Protected EAP Properties



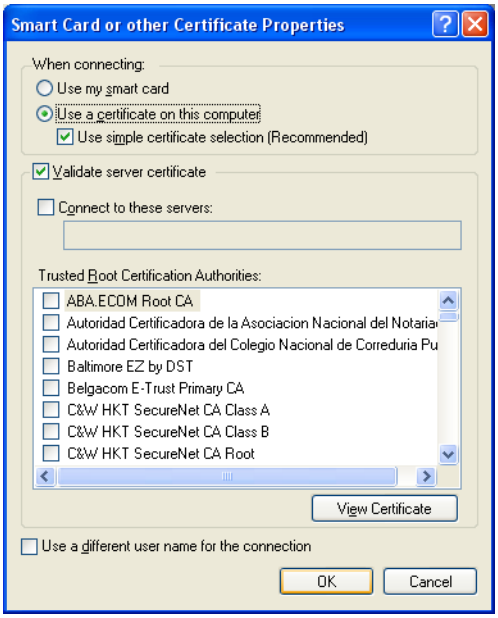
The following table describes the labels in this screen.

Table 34 Windows XP: Protected EAP Properties

LABEL	DESCRIPTION
Validate server certificate	Select the check box to verify the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. Note: You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
Do not prompt user to authorize new server or trusted certification authorities.	Select this check box to verify a new authentication server or trusted CA without prompting. This field is available only if you installed the Windows XP server pack 2.
Select Authentication Method:	Select an authentication method from the drop-down list box and click **Configure** to do settings.
Enable Fast Reconnect	Select the check box to automatically reconnect to the network (without re-authentication) if the wireless connection goes down.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Smart Card or other Certificate Properties

Figure 95 Windows XP: Smart Card or other Certificate Properties



The following table describes the labels in this screen.

Table 35 Windows XP: Smart Card or other Certificate Properties

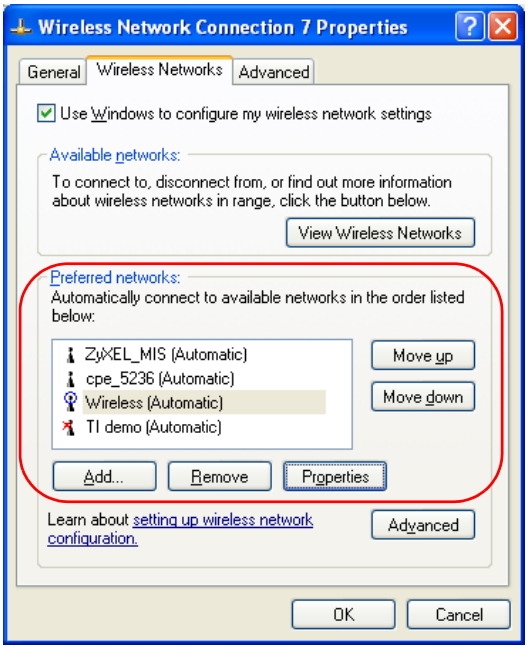
LABEL	DESCRIPTION
Use my smart card	Select this check box to use the smart card for authentication.
Use a certificate on this computer	Select this check box to use a certificate on your computer for authentication.
Validate server certificate	Select the check box to check the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. Note: You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
View Certificate	Click this button if you want to verify the selected certificate.
Use a different user name for the connection:	Select the check box to use a different user name when the user name in the smart card or certificate is not the same as the user name in the domain that you are logged on to.
OK	Click **OK** to save your changes.
Cancel	Click **Cancel** to leave this screen without saving any changes you may have made.

Ordering the Preferred Networks

Follow the steps below to manage your preferred networks.

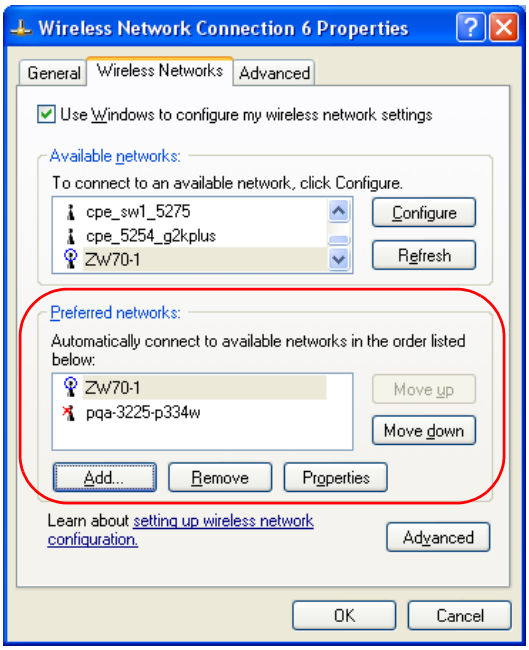
1 Windows XP SP2: Click **Change the order of preferred networks** in the **Wireless Network Connection** screen (see Figure 88 on page 105). The screen displays as shown.

Figure 96 Windows XP SP2: Wireless Networks: Preferred Networks



Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the screen as shown.

Figure 97 Windows XP SP1: Wireless Networks: Preferred Networks



2 Whenever the AG-220 tries to connect to a new network, the new network is added in the **Preferred networks** table automatically. Select a network and click **Move up** or **Move down** to change it's order, click **Remove** to delete it or click **Properties** to view

the security, authentication or connection information of the selected network. Click **Add** to add a preferred network into the list manually.

APPENDIX D
Wireless Security

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x.

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless station. The wireless station 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless stations for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the Wireless screen. You may still configure and store keys here, but they will not be used while Dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 36 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless stations. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless stations using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

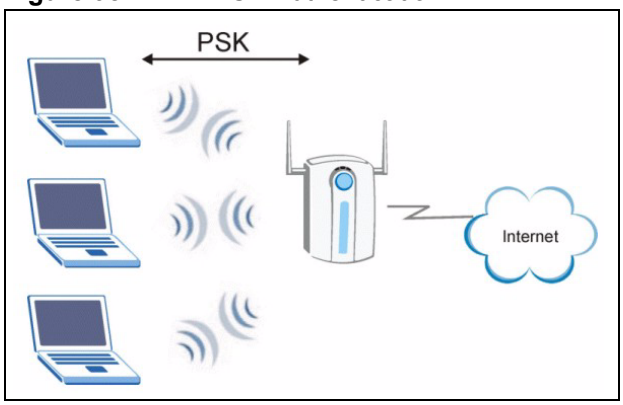
Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

WPA(2)-PSK Application Example

A WPA(2)s-PSK application looks as follows.

1. First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
2. The AP checks each client's password and (only) allows it to join the network if it matches its password.
3. The AP and wireless clients use the pre-shared key to generate a common PMK.
4. The AP and wireless clients use the TKIP or AES encryption process to encrypt data exchanged between them.

Figure 98 WPA-PSK Authentication

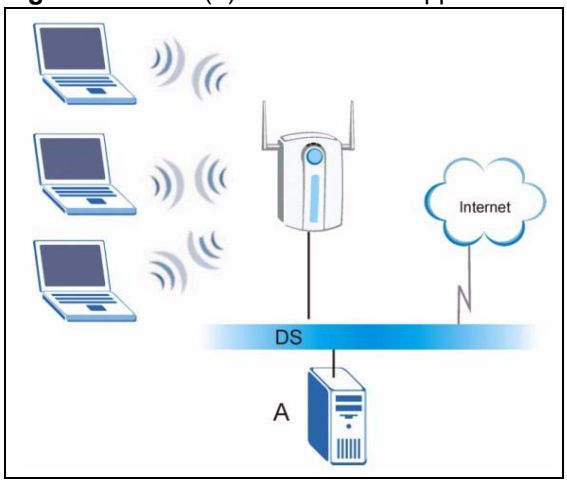


WPA(2) with RADIUS Application Example

You need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

1. The AP passes the wireless client's authentication request to the RADIUS server.
2. The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
3. The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the pair-wise key to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 99 WPA(2) with RADIUS Application Example



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each Authentication Method/ key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 37 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

APPENDIX E
Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 98/Me/2000/XP/Vista and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

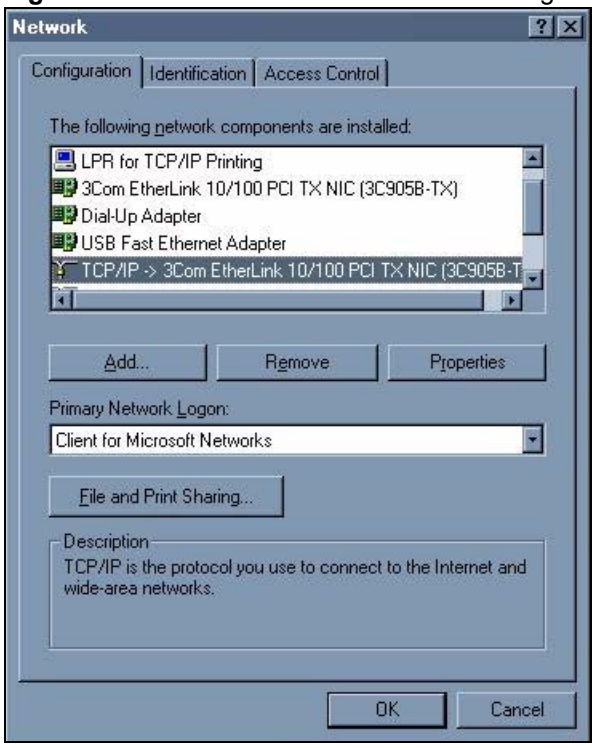
TCP/IP should already be installed on computers using Windows 2000, XP and Vista.

After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

Windows 98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window

Figure 100 WIndows 98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.

3 Select **Microsoft** from the list of manufacturers.

4 Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.

5 Restart your computer so the changes you made take effect.

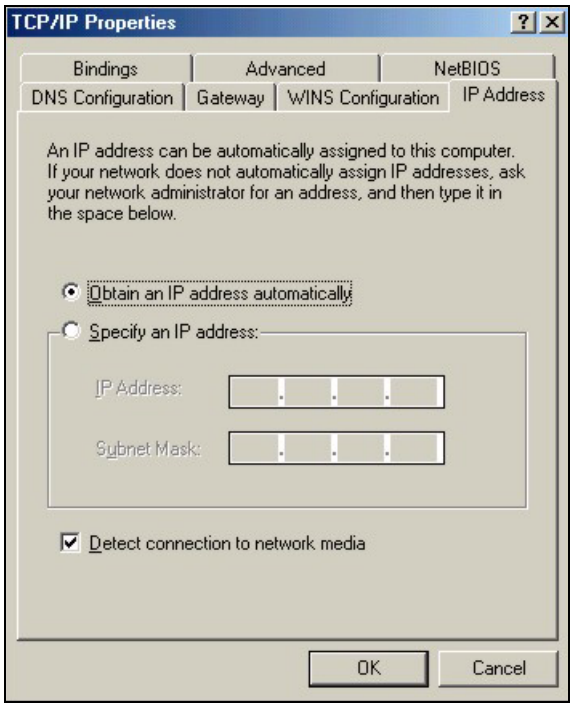
Configuring

1 In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**

2 Click the **IP Address** tab.

- If your IP address is dynamic, select **Obtain an IP address automatically**.
- If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

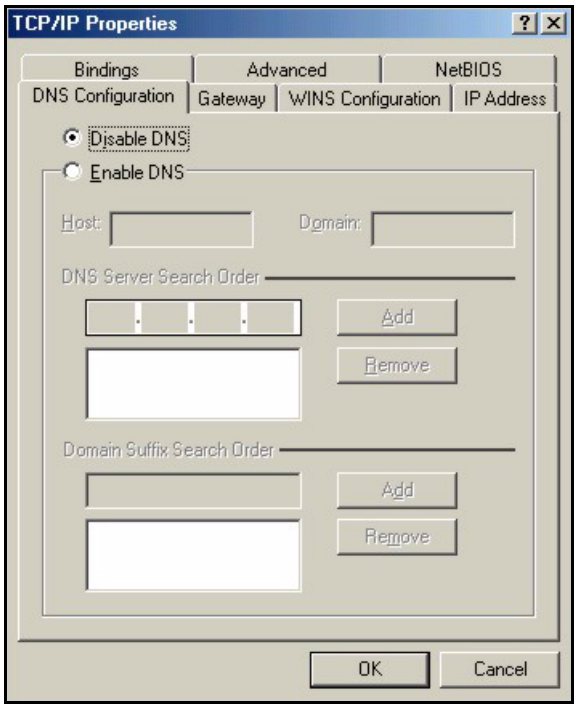
Figure 101 Windows 98/Me: TCP/IP Properties: IP Address



3 Click the **DNS** Configuration tab.

- If you do not know your DNS information, select **Disable DNS**.
- If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 102 Windows 98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.

- If you do not know your gateway's IP address, remove previously installed gateways.
- If you have a gateway IP address, type it in the **New gateway field** and click **Add**.

5 Click **OK** to save and close the **TCP/IP Properties** window.

6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.

7 Restart your computer when prompted.

Verifying Settings

1 Click **Start** and then **Run**.

2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.

3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/XP

1 For Windows XP, click **start**, **Control Panel**. In Windows 2000, click **Start**, **Settings**, **Control Panel**.

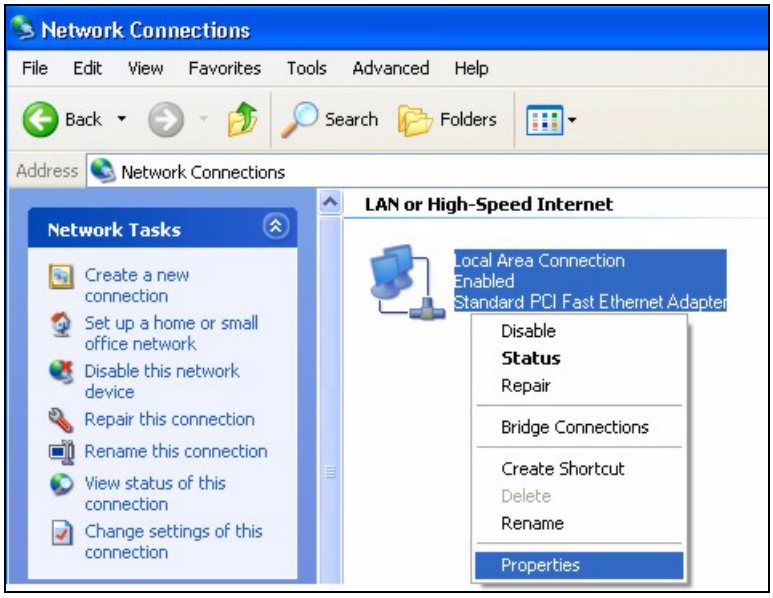
Figure 103 Windows XP: Start Menu

2 For Windows XP, click **Network Connections**. For Windows 2000, click **Network and Dial-up Connections**.

Figure 104 Windows XP: Control Panel

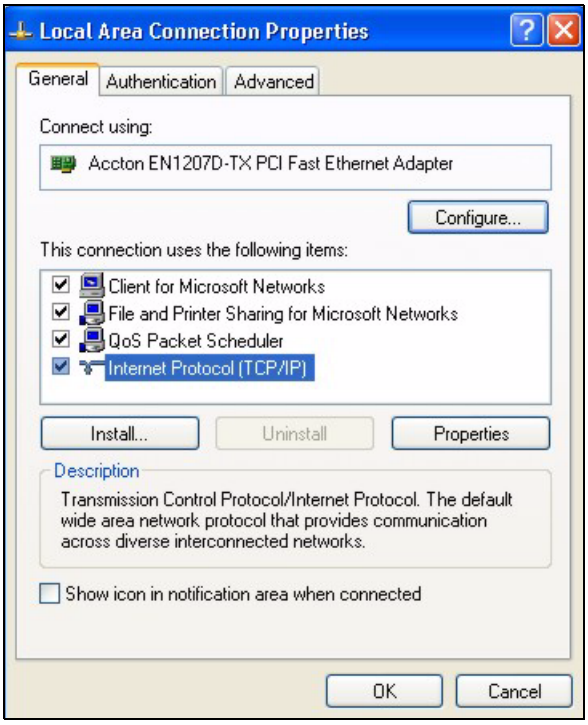
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 105 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and click **Properties**.

Figure 106 Windows XP: Local Area Connection Properties

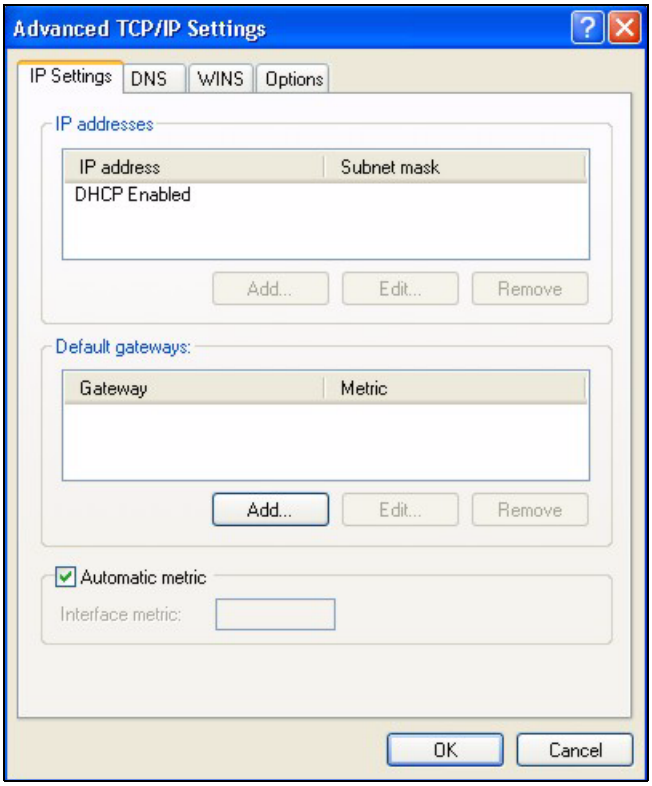


5 The **Internet Protocol TCP/IP Properties** window opens (the **General** tab in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.

- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields. Click **Advanced**.

Figure 107 Windows XP: Advanced TCP/IP Settings



6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

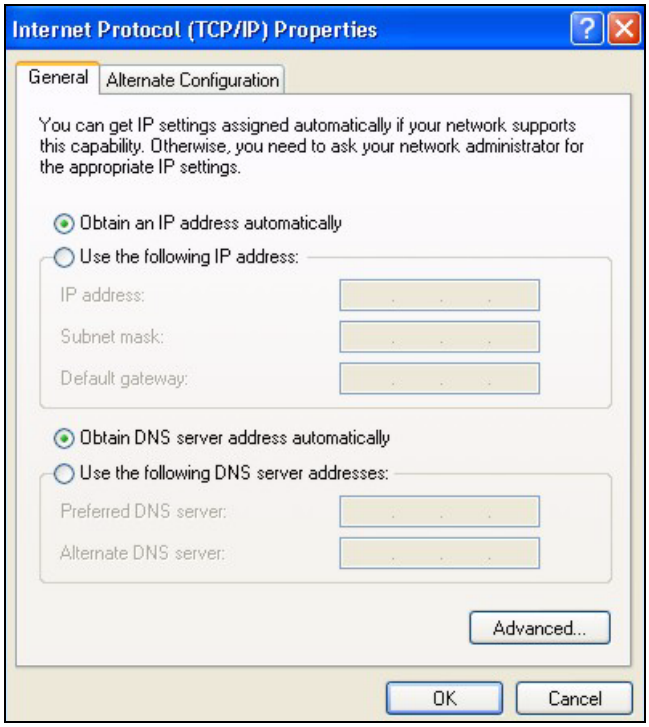
- In the **IP Settings** tab, in **IP addresses**, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 108 Windows XP: Internet Protocol (TCP/IP) Properties



8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **OK** to close the **Local Area Connection Properties** window.

10 Restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

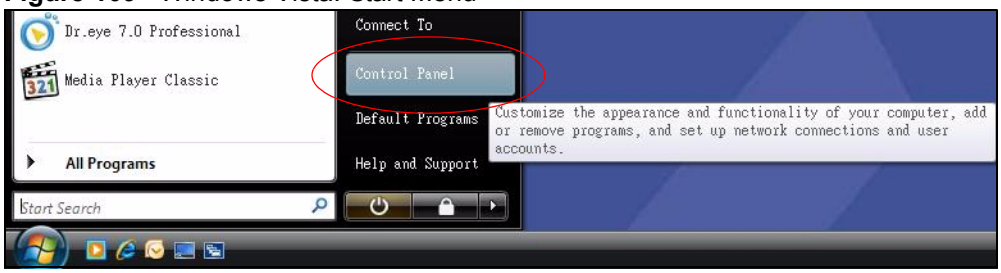
2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Windows Vista

This section shows screens from Windows Vista Enterprise Version 6.0.

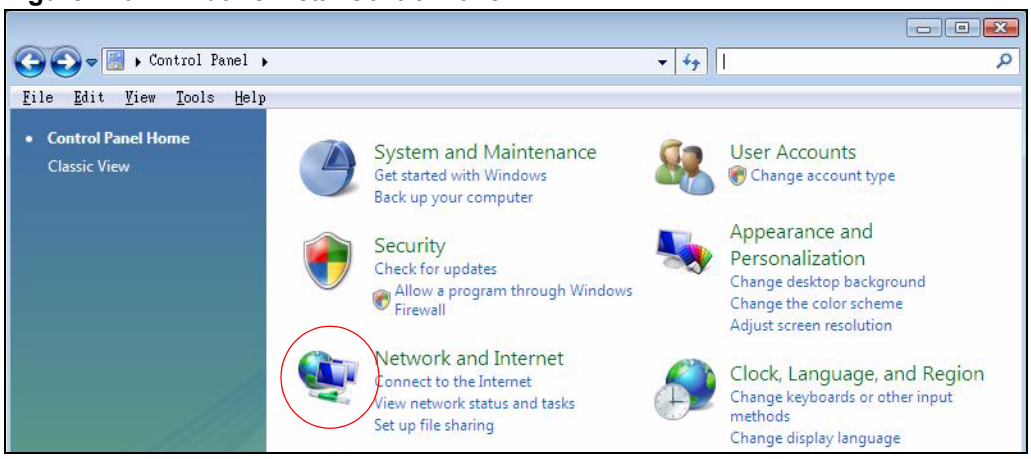
1 Click the **Start** icon, **Control Panel**.

Figure 109 Windows Vista: Start Menu



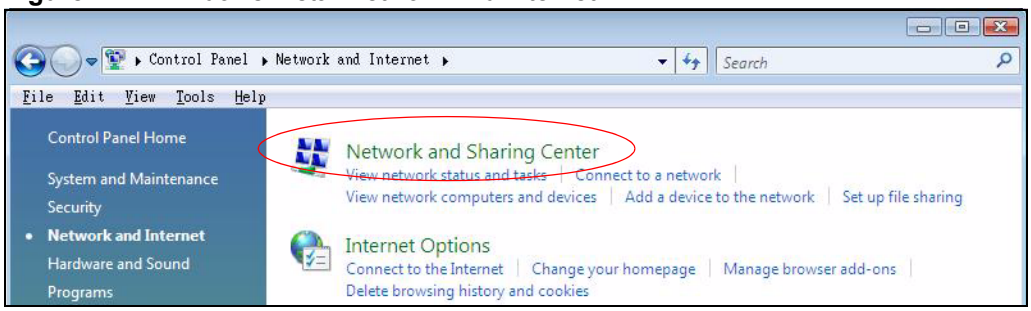
2 In the **Control Panel**, double-click **Network and Internet**.

Figure 110 Windows Vista: Control Panel



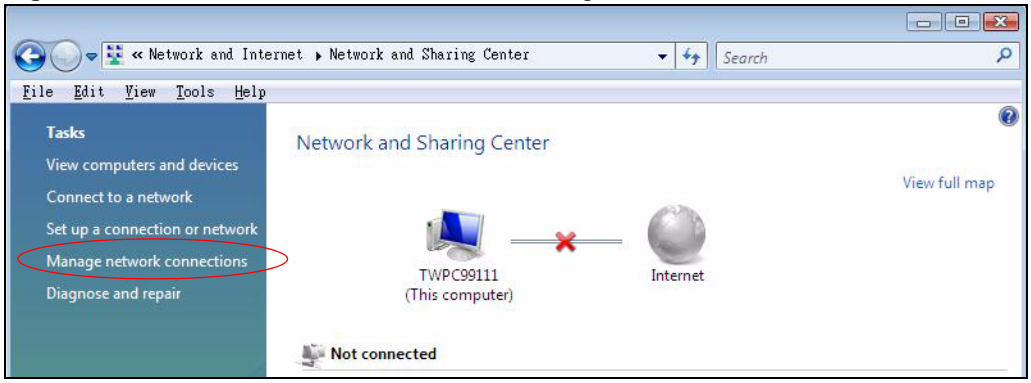
3 Click **Network and Sharing Center**.

Figure 111 Windows Vista: Network And Internet



4 Click **Manage network connections**.

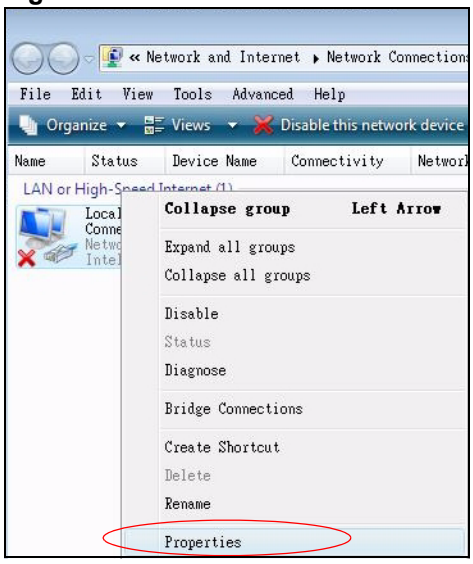
Figure 112 Windows Vista: Network and Sharing Center



5 Right-click **Local Area Connection** and then click **Properties**.

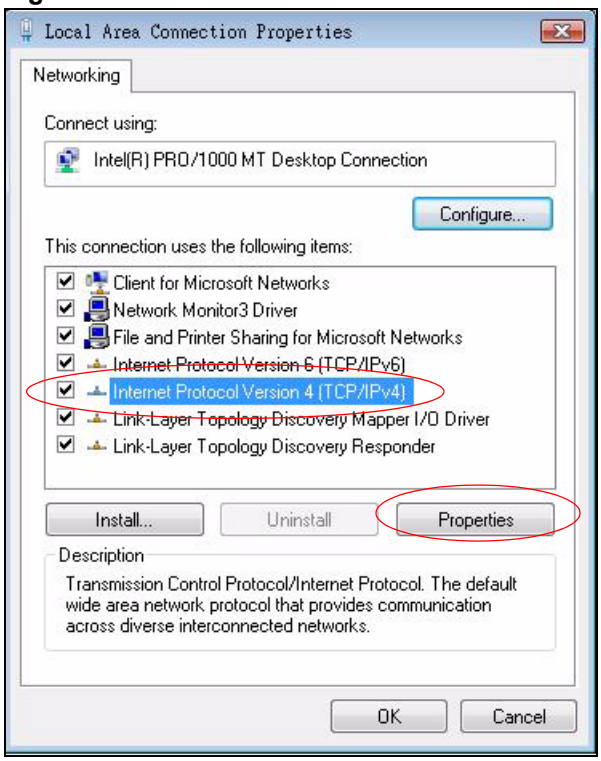
? During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

Figure 113 Windows Vista: Network and Sharing Center



6 Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

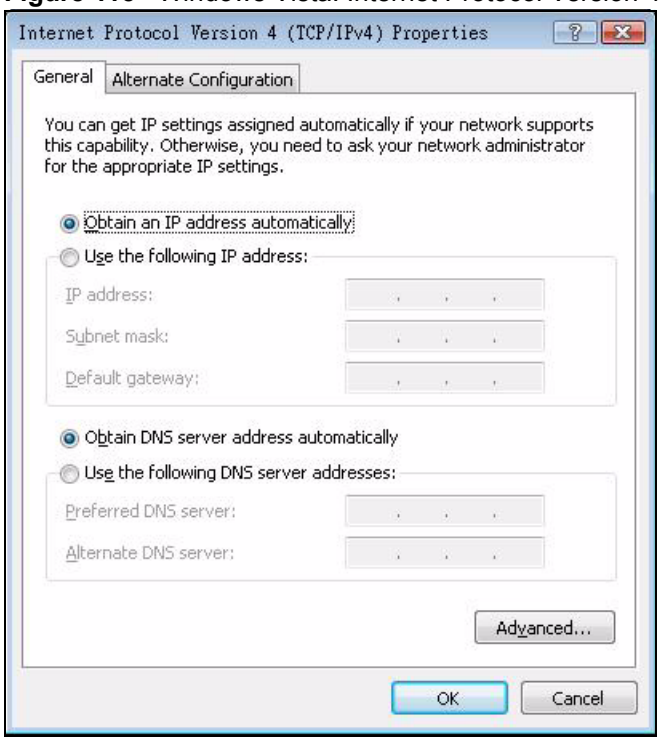
Figure 114 Windows Vista: Local Area Connection Properties



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens (the **General tab**).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 115 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties

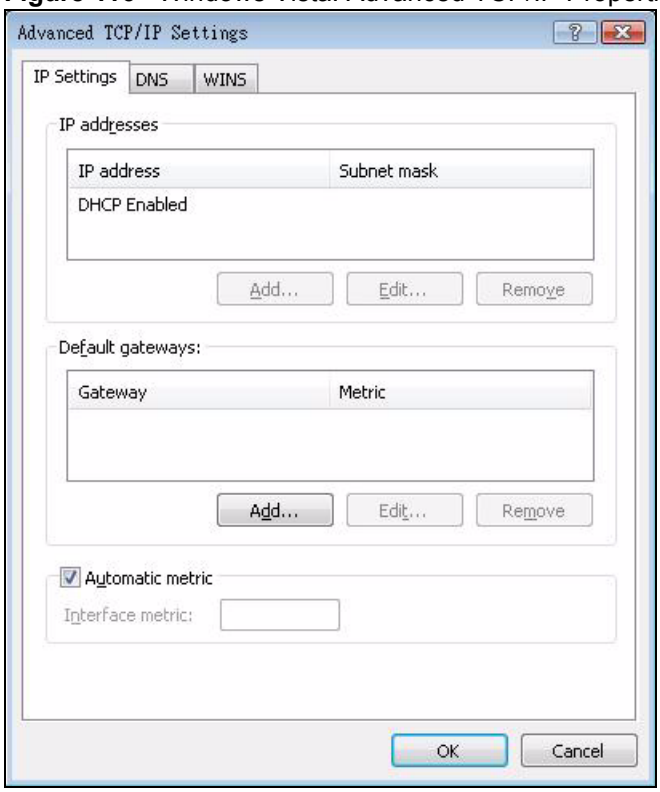


8 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 116 Windows Vista: Advanced TCP/IP Properties

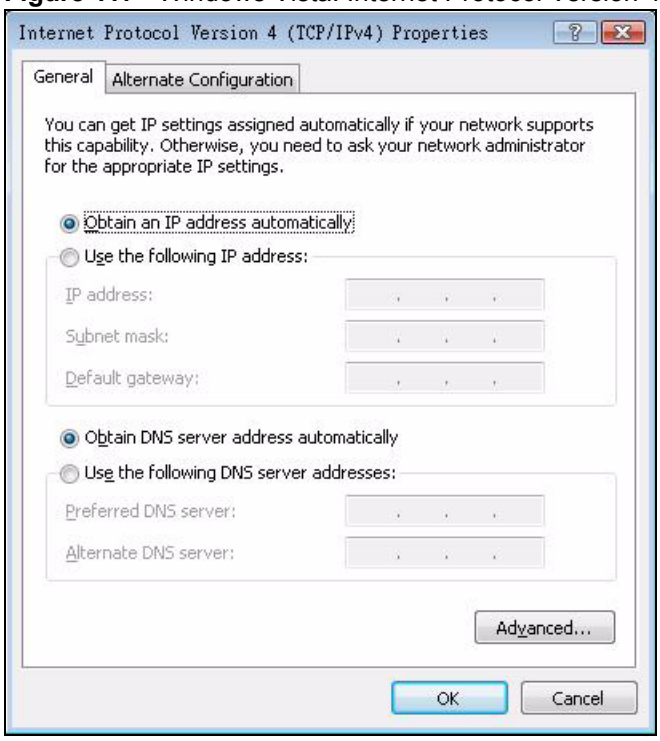


9 In the **Internet Protocol Version 4 (TCP/IPv4) Properties** window, (the **General tab**):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 117 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties



10 Click **OK** to close the **Internet Protocol Version 4 (TCP/IPv4) Properties** window.

11 Click **Close** to close the **Local Area Connection Properties** window.

12 Close the **Network Connections** window.

13 Turn on your AG-220 and restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

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